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A New Lighting Perspective

Price and Purpose

HOW far is the relatively backward state of lighting development to be attributed to the cost of energy and how far to the lack of education in its use? Backward—that is to say, if we are to accept the estimate given by Mr. W. J. Jones in his I.E.E. paper last week of 16,600 million kWh per annum as the potential lighting consumption of this country. Although electricity is without serious rival in providing illumination, public lighting only excepted, it is still only 25 per cent. of what it might be, measured on a kWh basis.

This estimate, as the author's supporting analyses showed, is by no means extravagant and, although the anticipated consumption for lighting is nearly as much as the total kWh sold for all purposes in Great Britain a couple of years ago, it allows for only reasonable increases over existing standards.

Taking bulk statistics, it is possible to deduce that, under present conditions, price reduction does little towards increasing lighting consumption and, moreover, may result in serious loss of revenue. This might seem to indicate that tariffs are not the vitally important factor that the experience of some engineers who took part in the discussion has proved them to be. In such cases, however, conditions were such that the primitive need of enough light to see by had not been met. Moreover, common ideas of what adequate illumination involves in ft.-candles are being drastically revised.

When lighting is regarded as having possibilities beyond those of bare utility, however, a study of the details of individual types of load, rather than bulk statistics, becomes more than ever essential, if price itself is to be used as a means of increasing output on a reasonably profitable basis.

Mr. Jones deprecates the quoting of a uniform type of tariff for all the diversified classes of lighting consumers, and indeed one would not tackle the industrial power business in this manner. He also does well to point out that the kVA basis tends to restrict the desirable trend towards the installation of higher-wattage lamps. Increasing the wattage may increase the fixed charges of giving the supply, but there is plenty of evidence that it increases the load factor much more.

Without a definite policy in regard to the use of price as a factor in development there is a risk that surpluses may be frittered away in making small concessions which bring little advantage to anybody, whereas big reductions for certain types of loads will enable light to be employed for decorative and other "luxury" purposes that will in due course come to be regarded as a necessity. Improvements that have taken place in shop lighting during recent years provide an illustration of the results of skilful tariff discrimination. While price has been found not to affect appreciably the amount of electricity taken at times of peak load, it is a material factor in encouraging, or otherwise, its liberal off-peak use.

There is a good deal more in it, however, than a question of favourable charges. Progress has been due very largely to an appreciation by the shopkeeper of what electricity can do for him in displaying his wares, and that is where skilled assistance can be rendered by the supply undertaking in educating him to get still more out of it. The appointment of lighting development officers (say one per 1,000 commercial consumers) has proved to be a handsome investment and also to have a prestige value.

While it is apparent that one cannot decide generally what are the relative influences of tariffs and education, it is clear that one must think in terms of things not as they are, but as they might be. Therefore standards of what is desirable should be made as flexible as possible, in order that they may be readily adapted to meet the needs of anything the future may hold in store.

The present outlook is the brighter because of the growing appreciation by architects, medical men, opticians and other professional advisers of the public of the help electricity can afford to them. An additional stimulus will be given by the implementing of the Ministry of Transport's Departmental Report on street lighting and by the new powers given to the Home Office to require adequate illumination in factories. This opportunity should not be missed.

Dr. Paterson's Address

READERS will recall the powerful plea for co-operation and co-ordination of effort made by Dr. C. C. Paterson at the recent E.R.A. annual luncheon. He referred particularly to the lack of effective contact between the supply and manufacturing sections of the industry and suggested means whereby such contact could be secured and whereby some sort of policy could be evolved for the internal affairs of the industry. It was generally felt at the time of the delivery of the address that it possessed more than ephemeral significance, and it is accordingly not surprising that the British Electrical and Allied Manufacturers' Association has had it reprinted in a handy booklet form ("Electricity in the Public Service: The Next Phase"). Copies are obtainable gratis from B.E.A.M.A., and all who are anxious to see a better understanding between the industry's partners should avail themselves of this opportunity.

Future Steam Conditions

IN commenting on the annual report of the E.R.A. recently we referred to the large savings in the cost of fuel burned in generating stations that could be attributed to research into the behaviour of metal at elevated temperatures. The co-ordination of physics, metallurgy and mechanical design that has produced these results has been of undoubted benefit to the consumer of electricity. In an article contributed to this issue by an engineer of great experience in the evolution of higher steam conditions, the author shows the physicist to be ahead of the metallurgist for the moment and the mechanical designer to be waiting to use anything that the metallurgist can let him have. The extent to which the electrical industry can make use of molybdenum steels, however, will depend mainly upon the price at which they can be produced. Although technical efficiency in generation has hitherto been the same thing, broadly speaking, as "dollar" efficiency, it does not necessarily follow that it will always continue to have an equivalent meaning.

Skilled Firing

A STOKER'S work means to the public at large a task requiring muscular effort but a minimum of intelligence. This was never true, even in the days of the hand-fired Lancashire boiler. On the introduction of the mechanical stoker many engineers, who realised how much more was involved in the duties of the human operative than shovelling coal and raking out ashes, asked for nothing more than that the machine should reproduce consistently the results achieved by good hand firing. The Chief Alkali Inspector, Mr. W. A. Damon, at the recent National Smoke Abatement Society's conference, urged that steam raising should be regarded as a skilled job to be entrusted to skilled men. He suggests that stokers should attend classes in the technique of combustion and should receive increased pay after gaining certificates of proficiency. The organisation of suitable courses of instruction deserves consideration by those concerned in the efficient burning of fuel.

The Largest Company

THE County of London Electric Supply Co. is the largest electrical concern in Great Britain, and its business continues to grow at a rapid rate. Last year it was responsible for the generation of about 1,915 million kWh, of which the Central Electricity Board took 715 million. Although this represented an advance of only 2.6 per cent. in the total, on account of the lower quantity taken by the Central Board, the increase in the sales to the company's own consumers amounted to practically 16 per cent., which was well above the national increase last year (13.3 per cent.). In point of fact, as the company was responsible for a substantial part of the national production (over 8.3 per cent.) it must have contributed considerably to the overall increase. A further 75,000-kW set (with boiler plant) is to be installed at Barking, raising the capacity of the plant to 540,000 kW.

Adequate Wiring

FOR twenty years, says our New York contemporary, the *Electrical World*, the electrical industry has faced the problem of inadequate wiring, but now it is "finally getting started on the road to getting results." In other words, it has begun a campaign to secure more wiring in American homes and factories. It must be said that the campaign is somewhat belated; over here E.D.A. has been waging such campaigns for many years—and is still at it. In this, as in other directions, it has had the valuable support of the Electrical Association for Women. Since the days of the Society for Electrical Development the United States has seemed to lack a national propaganda body. Good work is being done by the utility companies in their own areas (as is the case here), but a national organisation can conduct campaigns on a more satisfactory basis and for the good of the industry as a whole. But, of course, as in so many other matters, conditions are different in America.

Heat in Industry

THE latest of the electric heat booklets compiled by E.D.A.—No. 9 of the series—deals with miscellaneous applications and is likely to be at least as useful as any of its predecessors. In thirty-six pages it gives particulars, in some instances accompanied by line drawings, of common and uncommon contrivances for bringing heat to the job. Of some practical use to those who wish to make up their own appliances should be the section describing the more common types of heaters, which gives also such technical information as the loading and temperatures that can be employed in their construction. Their simplicity, however, does not make it any the less desirable that the user should be guided by expert opinion in choosing the most suitable type of heater for any particular purpose. While the special applications of heat discussed in preceding numbers of the series generally call for very low tariffs, many of the processes described in the present publication have so high a convenience value that demonstration of their merits is likely to be more effective than cutting prices.

Dearer Coal

THE rise in the price of coal during the past year or so is regarded very seriously by a number of electricity supply undertakings. In the case of the North Metropolitan Co., for instance, the increase has been of the order of 20 per cent., which caused the chairman to say at last Tuesday's meeting that if the rise continued the company might find it necessary to "reconsider the present rates of charge for electricity supplied." Hitherto electricity has been the one "commodity" which could boast of continued reduction in price in the face of increases in all other directions, and there is no doubt that this fact has been responsible for much electrical progress. We hope that it will be possible to maintain charges at least at present levels, but this seems to depend upon some control of coal prices which does not at the moment seem likely to be applied.

Exemplary Punishment

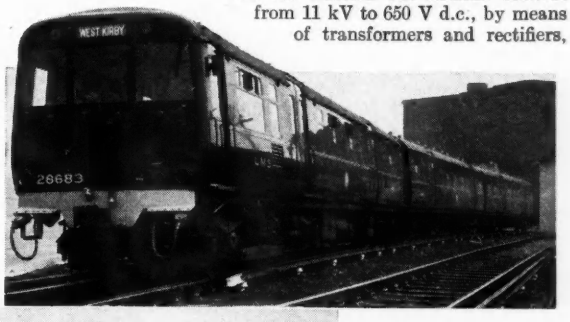
THE theft of electricity in this country is apparently not considered a serious crime; the penalty is usually about the same as for exceeding the 30-mile limit. In Illinois hitherto it has been regarded in a similar light—a misdemeanour punishable only under a city ordinance prohibiting tampering with an electricity meter. But things have changed there since the State Supreme Court ruled recently that electricity is "personal property." One result has been that a restaurant proprietor found guilty of stealing electricity worth $3,200 has been sent to the penitentiary for "from one to ten years." It looks as though the utility company concerned is likely to lose a substantial (if unremunerative) customer for some time.

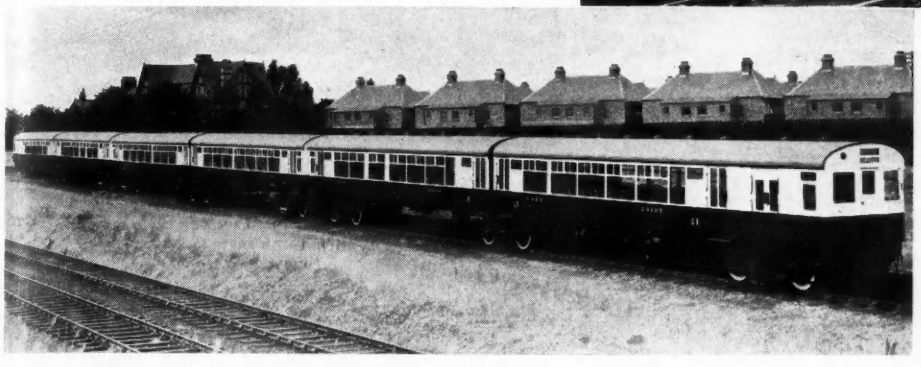
Electrified Northern Railways

Merseyside conversion and Tyneside extensions

THE completion of two railway improvement schemes has been celebrated this week. On the east coast the London & North Eastern Railway Co. has renewed the rolling stock for, and reconditioned the track of, the lines already electrified on the north bank of the Tyne; also it has very nearly finished electrifying the South Shields line south of the river.

On the west coast the London, Midland & Scottish Railway Co. has converted the Wirral Peninsula lines, providing accelerated and augmented services to and from Liverpool (Central), on the d.c. third-rail 650 V system, thereby facilitating through running on the under-river section of the Mersey Railway, which was electrified on the third- and fourth-rail system in 1903. The inaugural ceremony was performed on Monday by Sir Josiah Stamp and the work has been done under the Government loan guarantee schemes of the Railways (Agreement) Act, 1935. It covers a total of 24 single track miles, including sidings but excluding the Seacombe branch. 10- and 15-min. services will afford 20 per cent. more trains per day on the Wirral section and a 50 per cent. increase to Liverpool; a standard timing of 29 min. (stopping at all stations) replaces the steam-worked average schedule of 36 min.

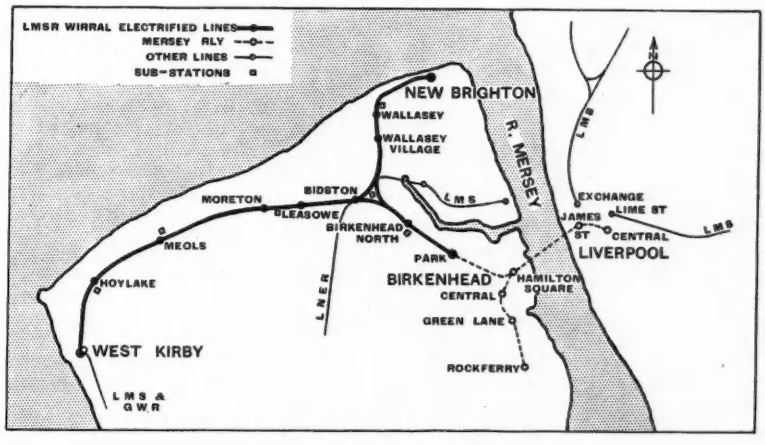




A new six-coach set for the North Tyneside lines (left) and a three-car set for the Wirral electrification

A considerable amount of civil engineering work was necessary to prepare the line for conversion, and the signalling system had to be altered and added to.

Three-phase, 50-cycle power is transformed to 11 kV at the Liverpool Corporation's sub-station and transmitted to the Railway Co.'s sub-station, where it is metered and provision made for isolating either of the two cables. Thence two feeders, each of 0.25 sq. in. per phase cross section, pass under the river to another sub-station at Birkenhead (North). The approximate length of each cable is 5,800 yd., and most of it is laid on battens supported by brackets well up in the roof of the Mersey Tunnel. The cable on this section of the route is lead covered and jute served. There is also a pilot cable for the feeder protective relays, for transmitting the kW demand metered at James Street to a repeating instrument in Birkenhead (North) sub-station and telephone pairs giving communication to Mersey Railway and to Liverpool Corporation, and provision for spares.



Route map of the L.M.S. Wirral Peninsula lines on which electrical operation was officially inaugurated last Monday. The Mersey Railway, electrified in 1903, is also shown

In the Wirral section the high-voltage feeders were supplied and erected by the J. L. Eve Construction Co., Ltd. The greater part are overhead stranded copper conductors. The insulators are of a special anti-fog type made by Steatite & Porcelain Products, Ltd. The earth wire is below the conductors. In general, the clearance between the nearest power wire and the telegraph and telephone wires on the opposite side of the track is 35 ft., but in some places it has been reduced to a minimum of 30 ft.

The line is of wood-pole construction, double circuits being carried on "A" or "H" poles, except for about 400 yd. beyond Moreton Station, where Rutter poles are used to give room for a footpath, in addition to the feeder route in the narrow margin available.

The six traction sub-stations convert from 11 kV to 650 V d.c., by means of transformers and rectifiers, and feed the track through high-speed breakers. The feeders are protected by time-graded overload and earth-leakage relays and, to comply with a restriction of the Liverpool Corporation that two feeders shall not be paralleled, alternate sub-stations are served by alternate feeders, with provision to bring all on to one feeder subject to the necessary interlocks. The form of "direct through" long narrow sub-stations fit conveniently into the sites available on the grass verges.

The high-voltage switchgear is of Crompton Parkinson manufacture and is solenoid-operated for remote control from 50 V batteries with separate leads for operating, tripping and indicating; it is of the compound filled, vertical isolation type, the rupturing capacity being 250 mVA at Birkenhead (North) and 150 mVA at the other sub-stations. The rupturing capacity has been tested on the new B.S.S. cycle at full rating and at three lower ratings. The relays and kWh meters are of Met.-Vic. manufacture, the latter being fitted with a contacting device so that, by connecting in a printometer instrument, a record of the input to a rectifier over any desired period can be obtained.

The rectifiers are of the Hewittic Electric Co.'s manufacture, each 600-kW set being arranged for six-phase connection in three bulbs, the fourth cubicle containing d.c. smoothing equipment. The cubicles are interlocked with the oil switches and the bus-bars are enclosed in the lower part of the cubicles. Provision is made for checking the sharing of load by the bulbs by means of a portable three-ammeter set. The anodes are protected by Allen West tetrachloride fuses mounted in a compartment in front of the bus-bars.

The d.c. switchgear is of B.T.H. manufacture, arranged for solenoid operation and held in by the main current. One breaker in each sub-station is arranged for closing off the track. The enclosure of all auxiliary devices and wiring is flameproof.

Apparatus of the Automatic Telephone & Electric Co.'s manufacture gives individual control and indication of all breakers from the control room at Birkenhead (North). There are two sets of pilots, one for two of the sub-stations, the other for the remaining three sub-stations. In each case a spare pilot is provided with facilities for change-over from one to the other. The pilots are continuously "proved" and an alarm is given if one becomes defective. The control of the d.c. breakers is arranged so that those at both ends of one track section may be closed simultaneously in from 3 to 10 sec., including automatic check back, without which no operation can be carried out.

Voice-frequency metering enables one reading to be obtained from each sub-station simultaneously, and provision is made for obtaining the d.c. output of the rectifier in amperes, or its voltage, or the voltage at the end of any track feeder; the latter facility provides a useful check on the performance of d.c. isolation.

Each sub-station contains a B.T.H. ancillary service transformer energised through a switch-fuse with limiting resistances, stepping down to 420 V and specially insulated to resist surges. At Birkenhead (North) this transformer is of 100 kVA capacity as it also serves to supply the car shed and repair shop. The others are of 25 kVA capacity, and in addition provide for lighting and signal supply. The low voltage output is controlled by English Electric switch-fuses, the single-phase loads being approximately balanced. Two similar transformers for lighting are of the outdoor type.

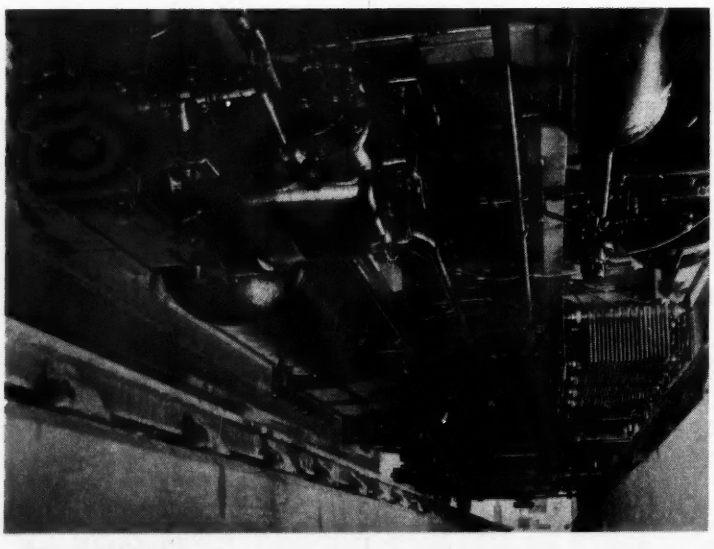
Each sub-station contains one battery for tripping and closing, for remote control apparatus and for emergency lighting. They are of the Britannia lead-acid type and are trickle-charged by Westinghouse rectifiers. Battery distribution is through a fuse-board with English Electric fuses.

The normal signal supplies are given at 240 V, single-phase from two sub-stations with an automatic contactor for changing over in emergency to two local supply authorities.

Special Rolling Stock

The nineteen three-car sets, each consisting of a motor coach, trailer, and driving trailer, are of the saloon type, with air-controlled sliding doors; the motor carriages were built by the Metropolitan-Cammell Carriage, Wagon & Finance Co., and the driving trailers by the Birmingham Carriage & Wagon Co.; some trailers were built by each company.

The coaches are of all-steel welded construction, built directly on the underframe. The tare weight of a three-car unit, including equipment, is 77 tons, and there are 181 seats, 40 of them first-class. Motor and trailer bogies are of welded construction throughout. The motor bogies are fitted with "Skefko" roller bearing axle boxes and the trailer bogies with Hoffmann boxes; both are of the thrust bar type, oil lubricated. For the Westinghouse electro-pneumatic brake system compressed air is supplied from a Westinghouse compressor on the underframe, and electrical control supply is from the 52 V train system.

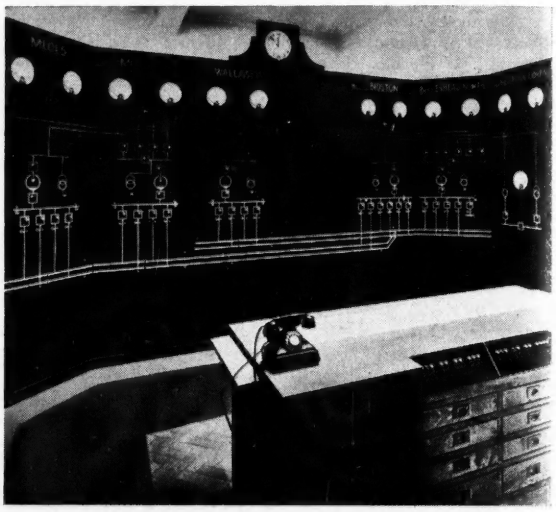


Electrical equipment on the underframe of a motor carriage (Wirral)

The complete rolling-stock electrical equipment has been supplied by the British Thomson-Houston Co., Ltd., Rugby. There are nineteen train units and the normal make-up will consist of a double unit of six coaches; 650 V collector shoes are provided on the motor coach and driving trailer, suitable for either running rail (earthed) or insulated return rail.

Each motor coach is equipped with four traction motors driving through straight spur gearing of 63/16 ratio. The motors are rated at 135 h.p. for one hour and 93 h.p. continuous. They are of the cast-steel, box-frame type with roller armature bearings and sleeve axle bearings, and are self-ventilated with a sliding bellows connection enabling air to be drawn through ducts in the coach and a louvred opening in the coach side.

The whole equipment is arranged for electro-pneumatic contactor operation and, on test, a single switch successfully interrupted an inductive load of 10,000 A at 600 V. A Westinghouse type DH.25 compressor is provided and this supplies air for operating the control, brakes, and door gear. For coupling between units nineteen-point plugs and sockets are provided for both control and auxiliary nineteen-core train cables, and these are bifurcated to permit coupling up from either side of the train. In addition, a positive bus line connects the coaches in a three-car unit and permits collector shoe power to be taken from either end of the train. There is also a three-core power coupler between the coaches in a unit, providing lighting and heating for the train under control from the motor coach. There are no power connections between the separate three-car units.



General view of control room at Birkenhead

A power receptacle is fitted at each end of a three-car unit to enable a shed plug to be used to supply power when the train is in the shed and out of contact with the conductor rail. Low voltage control for the electrical equipment, air brakes and door gear is provided by a 1-kW motor generator set at 52 V, and a cut-out relay and battery provide for emergency control in case of failure of the motor-generator set. Another relay across the 600 V supply connects the emergency lights throughout the train to the battery. The battery consists of thirty-six "Nife" alkaline cells in a steel cupboard slung from the motor coach underframe.

The four motors are connected with pairs permanently in parallel and with series-parallel control of the two pairs. Running notches are provided only for the full series and weak field positions. The master controller also has a "shunting" notch for low-speed running on the first series point. Provision is made for cutting out a pair of defective motors on any equipment by means of a manual switch on each motor switch group. In addition, on a six-car train either equipment can be cut out from any driver's cab by means of push-buttons which operate nine-point control cut-out relays on each three coach train.

As the Wirral trains will be running over the Mersey Railway, provision has been made for a negative shoe to operate on the Mersey fourth rail. Running rail return cannot be used owing to the track signalling circuits. An earthing contactor is normally closed when running on the Wirral lines and this connects the negative to the running rails so that the negative shoe is not in use.

Positive lighting, positive heating and common negative return bus-lines are provided. The lighting control is by means of a latched contactor in the driver's cab and controlled by

set and trip push-button switches in the guard's van. The heaters, each of 500 W are in pairs in series on the 600 V supply. Each coach has a total of 10 kW of heaters, the driver's cabs and guard's van each taking 1 kW. Control of the passenger compartment heaters is by means of a thermostat in the motor coach with alternative direct control from the driver's control panel on the motor coach.

The complete door equipment was supplied by G. D. Peters and Co., Ltd., Slough. The sliding doors are automatically operated by air engines controlled electrically by the guards. In addition, there are push-buttons by means of which passengers at stations with light traffic are able to open individual doors (when the circuit is made) and before the train departs the guard closes all doors opened and cancels the local opening circuit.

On the Wirral section a positive conductor rail of 105 lb. per yard flat bottom section (with running rail return) is used. The conductor rails are normally in 60 ft. lengths and bonded together by a welded U-shaped copper bond. The running rails have similar bonds of 0.166 sq. in. cross section. Cross bonding (welded) is carried out at frequent intervals by stranded copper bond 0.166 sq. in. cross section. Hook switches for isolating sections of the conductor rail are mounted in the permanent way adjacent to the conductor rail.

A repair shop and carriage shed have been built at Birkenhead North with overhead trollies and jumpers to enable the trains to run in and out under power.

The stations on the Wirral line are being reconstructed or modernised. The lighting of the bridges is by means of built-in electrical fixtures. Pre-cast reinforced concrete lamp posts are used at the main landings and cable conduit is built into the concrete.

Since Mersey trains will operate the New Brighton-Liverpool Central service modernisation of the stock has included new upholstered seats, motor driven air compressors in the place of storage reservoirs, electric heaters which will be necessary for the trains when running in the open, and switching arrangements for changing over from the fourth rail system on the Mersey line to the running rail return system on the Wirral section. In addition, four high-speed lifts have been installed at James Street Station. These are believed to be the largest electric lifts in the country and operate at a speed of 400 ft. per min.

Tyneside Reconstruction

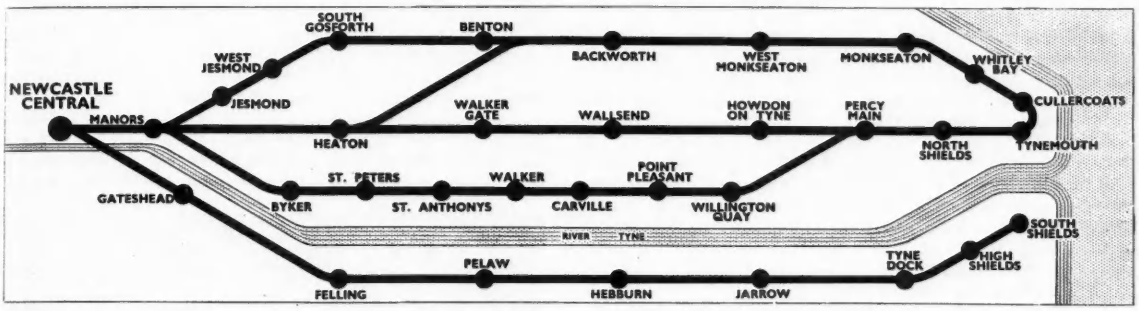
In 1904 the London and North-Eastern Railway Co. electrified the North Tyneside suburban lines from Newcastle (Central) *via* Wallsend to Tynemouth and Whitley Bay, thence back through Backworth and Jesmond, together with the riverside branch through Byker and a portion of the main line between Newcastle, Heaton and Benton.

The d.c. 600 V third-rail system was fed from five sub-stations which converted power derived from the 6-kV, 40-cycle network of the (then) Newcastle-on-Tyne Electric Supply Co. Heavier trains later necessitated the addition of two more sub-stations, remotely controlled from two of the original ones, and the change of a.c. distribution frequency to 50 cycles entailed the replacement of the original rotary convertors and transformers, the sub-station voltage being then increased to 630 V.

In addition, conductor rails with 50 per cent. larger section have been laid on sections where traffic is particularly heavy. Either-way working has been introduced between Central and Manors stations and a new station has been built at West Monkseaton to serve a new residential area. Track circuiting has also been introduced, together with other signalling improvements.

The reconditioning scheme provided for the replacement of ninety coaches and the reconditioning (by the B.T.H. Co.) of thirty-six vehicles (built in 1920) which were also equipped with Westinghouse electro-pneumatic brakes for use on the South Tyneside line. Orders were placed for sixty-four articulated two-coach motor-trailer units and four double-bogie motor vans, constructed to the specification of Sir Nigel Gresley, chief mechanical engineer of the L.N.E.R. Trains are made up of four articulated two-coach units, each unit weighing approximately 64 tons with normal passenger loading, and comprising one motor coach and one driving trailer. The motor coach is equipped with two 216 h.p., 600-V motors (one hour rating) together with undercar electro-magnetic contactors arranged for automatic acceleration.

The all-steel coaches were manufactured by the Metropolitan-Cammell Carriage & Wagon Co., Ltd., and the electro-pneumatic brake equipment by the Westinghouse Brake and Signal Co., with Reavell compressors, the electrical equipment being supplied by Associated Manufacturers of Electric Traction Equipment, Ltd. The electrical equipment on the original coaches was manufactured by the British Thomson-Houston Co., Ltd., which, as a member of "Ametel," was responsible for the layout and erection of the new equipment, the motors of which were made by Crompton Parkinson, Ltd., with control gear by Allen West & Co., Ltd. "Skefco" armature bearings are fitted and brushes are of the Morgan Crucible Co.'s and Le Carbone makes.



Route diagram of the Tyneside electrified lines

The L.N.E.R. was pressed by the Minister of Transport to alter the position of the conductor rail to conform to the standard adopted subsequently to the original electrification. This necessitated moving the conductor rail 3¼ in. for the entire 80 miles of electric track, involving the removal of 50,000 insulators and the alteration of track continuity cables, as well as altering the current collecting equipment on all coaches. The whole of this work was done in a single week-end, the Sunday and Monday services being worked by steam.

The first of the new trains was placed in service on July 30th, 1937, and delivery of all the new coaches was completed by the end of last year. Since the completion of the scheme on January 3rd, 1938, stopping trains from Newcastle back to Newcastle, *via* Tynemouth, are now allowed only 53 instead of 63 min. for the round trip and expresses from Newcastle to Tynemouth take 24 instead of 30 min.

The newly electrified line on the south bank of the Tyne is eleven miles in length. It is a Newcastle-South Shields suburban line used by five million passengers a year. For interchangeability the third rail system with 630 V at sub-stations has been adopted and platforms at Hebburn, Tyne Dock and High Shields stations have been lengthened to suit eight-coach trains. Approximately 2,360 tons of steel conductor

First-class smoker (Tyneside)

Utilising Waste Milk Products

New equipment at two modern factories

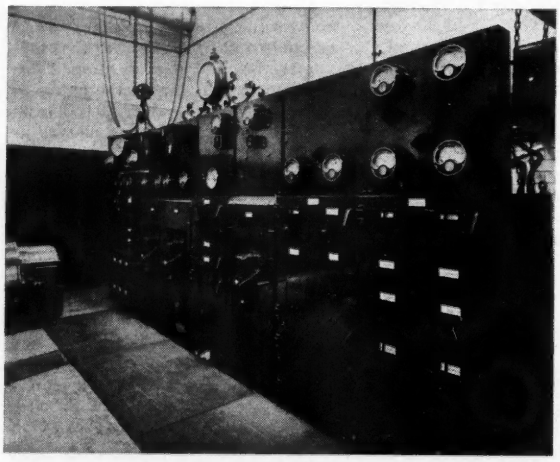
The conversion of waste products into marketable by-products is becoming a profitable business in many factories

IN the majority of industries, the importance of converting so-called waste products into marketable by-products is not to be ignored. A typical case is that of Aplin & Barrett, makers of "St. Ivel" lactic cheese and "Golden Meadow" butter, who are now converting the skim milk left over from butter making into a powdered form for the baking and similar trades by the introduction of a spray-drying system. In carrying out this installation, additional plant was also installed throughout their Frome and Wellington factories for purposes of general modernisation.

At the Frome factory the old 130-V d.c. generator was scrapped in favour of a 400-V, 3-phase, 50-cycle plant, thus enabling the public supply to be utilised when required for additional load or standby. Public supply is utilised at Wellington in a similar way. At Frome, and in a modified form at Wellington, a Crompton Parkinson seven-panel, ironclad industrial-type, main switchboard has been installed in the engine room.

The first panel controls the outgoing single-phase circuits for lighting, the top swinging portion accommodating the synchroscope and voltmeters for use in paralleling the two sets. The second and third panels contain oil-immersed circuit-breakers, ammeters and watthour-meters for the control of the two alternators. The fourth panel is for voltage control and the power-factor meters, earth leakage trip and interlocked change-over switch; the fifth panel is for the main outgoing circuit-breaker and auto-synchronous motor control for power-factor correction. On the sixth and seventh panels are selector switches to enable power to be selected from either the private or public sources of supply.

In the Frome engine room are the ammonia compressors for refrigerating plant driven by 35-h.p. drip-proof slip-ring induction motors direct-coupled and running at 475 r.p.m.; two



A seven-panel "Ironsafe" main switchboard at Aplin and Barrett's Frome factory

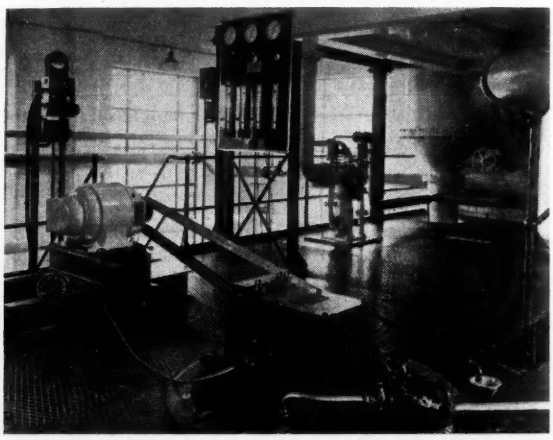
horizontal vacuum pumps driven by 10-h.p. and 5-h.p. slip-ring and squirrel-cage motors, respectively, and various water pumps, &c., direct-coupled, with E.A.C. control gear.

Two 9-h.p., 400-V, 3-phase, 50-cycle, 1,430-r.p.m., protected enclosure squirrel-cage induction motors direct-coupled to centrifugal pumps, work in conjunction with Mirrlees multi-jet condensers for the Ashworth & Parker pass-out steam engines.

Since throughout the various operations there are demands for both steam and electrical energy, the generators are driven by steam engines operating as pass-out sets. The steam is exhausted for general use at 20 lb. per sq. in., and is reduced for use in the evaporator and pre-heater. The generating plant consists of two screen protected enclosure alternators capable of an output of 0.8 power-factor of 125 kVA at 400-V, 3-phase, 50 cycles, 428 r.p.m., direct-coupled to 150-h.p. triple expansion extraction steam engines through flexible couplings.

The alternators supply the power normally required for the general manufacture of the by-products from milk, while the pass-out steam from the engines is employed for pasteurising, sterilising and general manufacturing purposes.

A 30-h.p., 400-V, 3-phase, 50 cycle pipe-ventilated auto-synchronous motor drives at 1,500 r.p.m. the hot air fan is necessary for the manufacture of milk powder by the Kestner process. The air is heated to the required temperature by the



A 7½-h.p., pipe-ventilated, squirrel-cage induction motor driving the atomiser unit for making milk powder at the company's Wellington factory. Note the special transmission belt

use of waste flue gases. The capacity of the spray-drying plant averages about 500 lb. of powder per day. It consists of a large chamber made of tinned steel into which the milk is admitted through an atomiser from which it emerges in the form of a fine spray. This comes into contact with the hot air introduced tangentially into the chamber, thus converting the spray into a fine powder.

At Frome, there are about 130 motors installed for various duties, ranging from 35 h.p. to fractional sizes, including several geared units, and at Wellington there are nearly 100 motors. Over 90 per cent. of these were supplied by Crompton Parkinson, Ltd., including the alternators and main switchgear, and over 90 per cent. of the motor starters at both places were supplied by the Electrical Apparatus Co., Ltd.

Electrified Northern Lines (*Concluded from preceding page*)

rail was supplied by Dorman Long & Co., Ltd., and the Cargo Fleet Iron Co., Ltd.

In November, 1937, the third rail was made alive with energy obtained at 5.5 kV from the North Eastern Electric Supply Co., Ltd., at four sub-stations in which are six 1,000-kW steel-tank mercury-arc rectifier sets with transformers and switchgear, two sets being in each of two sub-stations and one set in each of the other two. All four are operated by supervisory remote control from the Railway Co.'s control room at Wallsend sub-station on the North Tyneside line. The electrical equipment for these sub-stations has been supplied by the British Thomson-Houston Co., and the supervisory remote control equipment by Standard Telephones & Cables, Ltd. Derby cables have been used. It is hoped to have the full electric train service in operation on the South Shields line early in the spring, when the journey time between Newcastle and South Shields will be reduced from 34 to 27 min.

The new North Tyneside vehicles are of the twin-articulated type, in order to reduce weight, with seats of the bucket type. In addition there are four motor vans of the double motor-bogie type. Two are arranged as driving-luggage-motor-thirds and work with a six-coach set of converted steam coaches during peak periods, and two are designed to work fish or goods services. The total weight of a twin unit in working order is 56 tons. The large saloon in each first-class vehicle is convertible into third class for off-peak workings. Each body and underframe, both of steel, combine to form a single structure, fabricated by electric welding; but the bodies are riveted, welding being employed only for minor joints. The open-type saloons have single sliding doors at each end. There are twenty-four 60-W Crompton Parkinson lamps of the screw-cap traction type in each body, in plain reflector fittings without shades (W. M. Still & Co.). Tubular electric heaters (Unity) are provided on the body sides, protected by perforated guards and controlled by a thermostat at the centre of each coach. which is a new feature.

A Sub-standard Telephone Reference System

By C. M. R. Balbi, M.I.E.E.

The method described enables the calibration of acoustic apparatus and research to be carried out simultaneously

THE measurement of sound transmission in the design and testing of acoustic apparatus is a necessity to all research engineers, as the only alternative to measurement is the hit and miss principle and that is totally inadequate for the improvement of modern acoustic appliances. The problem is made difficult by the expense of the very delicate calibrating equipment necessary for the determination of the minute quantities of energy involved.

Such bodies as the N.P.L. will undertake the calibration of apparatus for firms or individuals, but when a design has to be finished in a specified time the delay occasioned by the sending of apparatus to a public body, with the chance that modifications and a retest may be required, is a handicap to speedy progress. It was for this reason that the design of a sub-standard telephone reference system was undertaken to enable research and calibration to be carried out simultaneously, by colleges and firms that can justify the expenditure of about £500, which represents a mere fraction of the cost of a " master " reference system.

The whole is built into a rack frame and consists of four

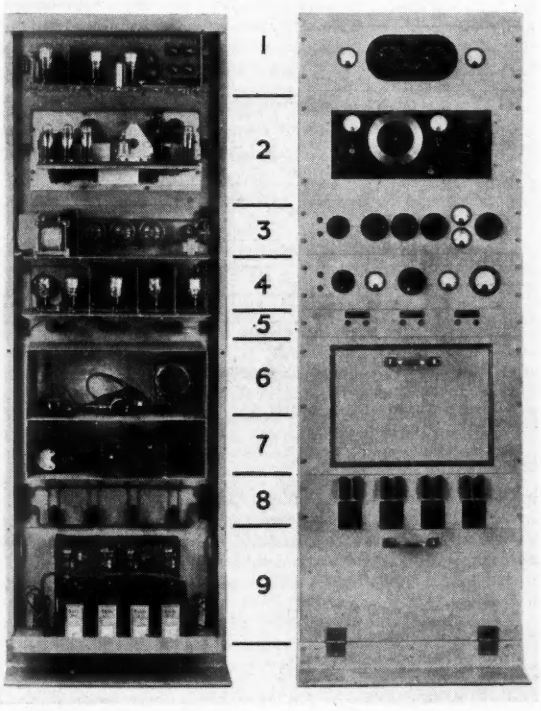


Fig. 1.—The apparatus for measuring sound transmission
1. Fixed frequency oscillator. 2, Variable frequency oscillator. 3, Attenuator. 4. Valve voltmeter (A). 5. Jack panel. 6. Collapsible table. 7. Valve voltmeter (B). 8. Fuses and switches. 9. Power supply.

main panels for (top) the fixed frequency oscillator, under which are a variable frequency oscillator, attenuator and valve voltmeter, with subsidiary switch panel, a jack panel and a special collapsible table to enable test equipment to be used in close proximity to the rack. In the base is housed the power supply equipment, each unit being entirely separate both as regards high- and low-voltage supplies. This separation was found necessary to the avoidance of cross-talk and interaction generally.

Taking the panels in order, the first oscillator is capable of providing sixteen fixed frequencies, covering that portion of the audible range which is useful in telephone measurement. Variation is from 62.5 cycles in steps of half-octaves to 11,200 cycles. Each of these frequencies is individually attenuable, and is transferred to an l.f. amplifier mounted on the same panel, which provides sufficient output to operate a " calibrated sound reproducer " external to the rack.

The next panel is a heterodyne oscillator, with frequency continuously variable from 20 to 12,000 cycles, approximately of the same range as before. The output, however, is not so great in this case, being of the order of 10 V across 5,000 ohms. The frequency of this oscillator is checked by the methods that I described in the *Wireless World*, August 2nd, 1935 (see correction chart, fig. 2).

The attenuator consists of a decade potential divider arranged to apply tenths, hundredths and thousandths of a given voltage across a decibel attenuator. Thus, if the input is set by direct measurement (by means of an external valve voltmeter (B, fig. 1) with a range of 0.1 to 16 V in five ranges) any fraction of a volt can be obtained down to an a.c. voltage of 0.1 millivolt. The fader into which this operates consists of twenty-four steps of 5 db per step. This, in turn, is fed to the grid of an output valve matched to a 20 ohm line. With this panel it is, therefore, possible to apply a very small fraction of a given voltage to a telephone ear-piece, by means of the potentiometer, and still further to attenuate that voltage by the fader until a theoretical limit of 10^{-10} V is obtained.

With the aid of a calibrated ear-piece for which the sound pressure in dynes per square centimetre is known for any given voltage and frequency (as in the accompanying example, fig. 3) any sound of a pure sinusoidal form can be aurally balanced to an accuracy of 1 db by a trained operator.

The last panel is a valve voltmeter (A, fig. 1) which is capable of giving a full-scale deflection with an input of 5 mA. Five valves are used in this panel, the first three being voltage amplifiers, the fourth a voltmeter valve and the fifth a compensator, arranged to keep the total anode current constant, despite the variation in anode current of the voltmeter valve.

The three stages of voltage amplification are linear within the limits of frequency obtainable from the fixed and variable frequency oscillators, and a decibel fader is incorporated as gain control. A high resistance potentiometer is connected in the grid circuit of the first stage to prevent its being overloaded on large inputs, and to enable the gain to be adjusted independently of the fader.

Outputs from the fixed frequency oscillator, variable frequency oscillator and attenuator are brought down to the jack panel, each output being given two jacks. This arrangement is very convenient and enables both test instrument and measuring instrument to be applied to the same output.

The whole of the above equipment is battery-operated, but mains operation can be provided for if required.

What the Equipment Will Do

Some idea of the usefulness of the equipment can be gained from the following rough outlines of experiments which may be carried out with its aid.

For the calibration of filters, amplifiers or transformers the output from the variable frequency oscillator is applied to the attenuator and thence to the input of the filter through the necessary matching impedance, the output from the filter being applied to the valve voltmeter (A, fig. 1). The input voltage is then adjusted to the normal working voltage of the filter and maintained constant over the whole frequency range (by voltmeter B). The characteristic of the filter may then be taken directly in decibels, by adjusting the fader on the valve voltmeter to give constant deflection at each frequency. Fig. 4 shows the relative impedance offered by a simple network of a 0.72 henry choke (air core) and a 0.0037 μF. condenser at varying frequencies.

For the calibration of telephone receivers the output of the fixed frequency oscillator is applied through a suitable matching transformer to a calibrated telephone receiver, and the voltage across it adjusted to give a known output above threshold (by voltmeter B) at a test frequency of, say, 1,000 cycles. The receiver to be tested is connected to the variable frequency oscillator and to the input of the valve voltmeter (A), the sound intensity of this is balanced against the first, and the fader indication noted. The frequencies are then varied and the same sound level obtained from the standard receiver in each case by application of the correct voltage. Input to the receiver under test is varied until balance is obtained, when the variation in its input can be measured in decibels by obtaining constant deflection on the valve voltmeter (A). Fig. 5 compares the results taken for a telephone ear-piece calibrated by the N.P.L. with the above method. The results agree within the practical limits of the system.

The calibration of a complete acoustic system is relatively not a difficult matter, for if desired the various components

may be calibrated singly and then summated. This is perhaps the best way when one is dealing with the large pieces of apparatus to be found in a public address equipment, but in any case the calibration of the microphone is the most difficult because if great care is not taken the acoustic features of any construction within the vicinity of the microphone may play a prominent, but deceptive, part in the results. For this reason calibration tests are often made in the open air, or else a soundproof chamber very heavily lagged with sound absorbent material, such as cotton wool, so that reflections producing standing waves are reduced to the minimum.

But it may be desired to sacrifice some efficiency for a more handy method, if a saving of space can be effected. With this view in mind I have produced a calibrated sound reproducer, which consists of a soundproof box with a dynamic unit inside and an external opening of about 1¼ in. diameter in front of the cone. It is so arranged that when the calibrated sound reproducer is connected to the fixed oscillator a sound pressure will be delivered against a membrane of 60 phons above the threshold of minimum audibility for the normal ear at any of the 16 frequencies. This can be obtained direct from an aural balance with a calibrated ear-piece. If a microphone is now substituted for the ear of the operator a valuation of the sound pressure at the ear-piece can be obtained directly as a decibel gain at each test frequency on the same lines as previously described.

For the purpose of testing deaf aids the uniform loudness of 60 phons above the threshold of normal audibility proves a most convenient standard, as it represents the average sound level at which microphones used for deaf aids have to pick up.

The distance between the diaphragms of the microphone and the dynamic unit is made as small as possible on account of the formation of standing waves over the frequency spectrum it is required to measure, so in this respect a practical way of obtaining a calibration is provided.

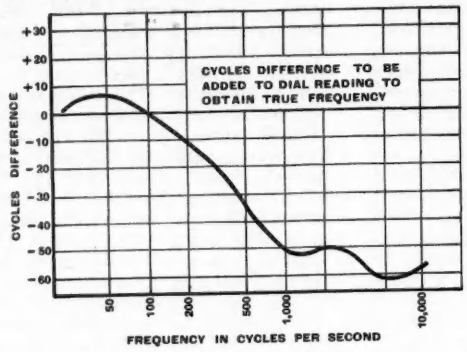


Fig. 2.—Frequency correction chart for variable oscillator

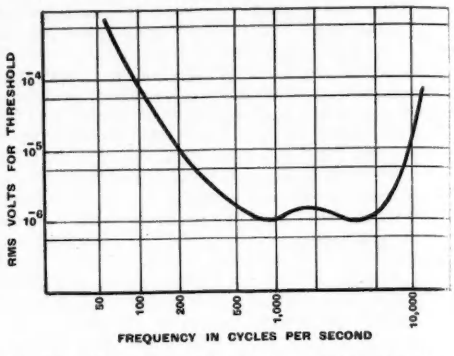


Fig. 3.—Calibrated earpiece reference chart for the production of sound of required frequency and intensity

The calibration curve of a commercial hearing-aid is shown in fig. 6. Those who expect to see a linear response will be sadly disappointed when they are told that the calibration is one of the best for any commercial valve hearing-aid at this period. Unfortunately, in order to make up for what is lacking in reality, claims have been made which are grossly misleading.

The matter of standardisation is therefore one of urgent necessity, and I hope to publish a further article on the testing of hearing-aids which will throw an entirely new light on the subject.

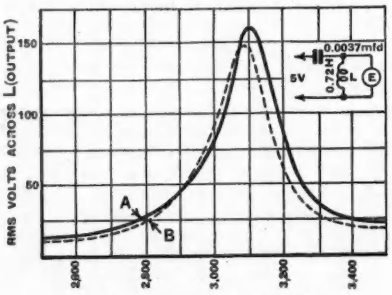


Fig. 4.—Calibration of a simple filter circuit

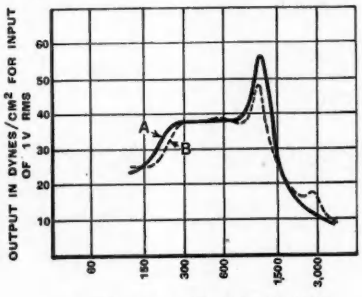


Fig. 5.—Calibration of a telephone earpiece

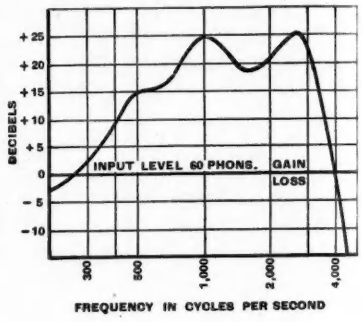


Fig. 6.—Calibration of a commercial deaf aid

Electrical Advance in Australia

DEALING with progress in Brisbane in his report for the year ended June 30th last, Mr. J. H. Hindman, manager of the Electricity Supply Department, reveals that sales of energy increased by 25 per cent. to 51.5 million kWh and consumers by 3,143 to 53,639. The rise in the number of domestic appliances connected of 9,344 was the largest yet recorded, the total of 87,273 including 2,239 ranges and 1,751 water heaters. The most notable development during the year was, however, in industrial power supplies, which improved by 48 per cent. to 28.4 million kWh. This was due partly to increased industrial activity and partly to several important concerns coming on to the Department's system. The City of Brisbane, with an area of 385 square miles and a population of 300,000, has within its boundaries an extensive rural area, electrification of which has proceeded rapidly. Supply has been taken by many farms for irrigation, incubation and chaff cutting. In addition, large commercial florists have recently applied soil heating very successfully to the propagation of plants. No instance is known of a farm that is within reasonable distance of a supply line using anything but electricity for irrigation, and more than 100 motors, aggregating 300 h.p., were installed during the year for this purpose. Electric incubators and brooders have almost wholly superseded the lamp-operated type. Judging from the satisfaction expressed by power users, Mr. Hindman does not anticipate difficulty in electrifying practically any farm process requiring power or heat. Last July a new tariff schedule came into force. Under this the rate for domestic supplies is 10 kWh per residence per month at 4½d. per kWh, next 20 kWh at 2d. and all in excess at 1d. No applications for a two-meter rate are now accepted. For continuous thermostatically controlled domestic water heating there is, however, a separate rate of 0.65d. The Department operates a radio station, which has enabled immediate attention to be given to supply interruptions with a consequent limitation of loss of revenue. There was a profit on the year's working of £50,082, although the net revenue per kWh sold fell from 1.87d. to 1.66d. The average kWh sold per consumer (exclusive of public lighting) was 926. The maximum demand on the system was 13,361 kW and the system load factor 50.25 per cent.

A correspondent reports that the Clarence River County Council has decided to accept the New South Wales Government's offer of a subsidy for rural extensions. Approval has already been given to a number of extension schemes, including Terania (£5,270) and Nambucca (£12,185), and others awaiting authorisation include Dorrigo (£1,100), Bellingen (£6,500) and Harwood (£2,000).

In Victoria the total sales of the State power system in the twelve months to June 30th last were 406.3 million kWh, an increase of 38.6 million kWh over 1935-36. The Electricity Commissioners point out that in order to avoid the possibility of the demand overtaking the net capacity it is necessary for still further plant to be in operation by 1941. The progressive extensions of the Newport "B" stations at a cost of £8,500,000, approved last year, cover the period from 1939 to 1948, and the first 20,000 kW of the Kiewa River scheme is expected to be ready by 1942 (altogether 104,000 kW is planned, at a cost of £6,136,000).

The Leipzig Fair. By Viola Ripley, B.Sc.

A review of the electrical exhibits

THE necessity of using home-produced materials has resulted in interesting new developments in light alloys, moulded materials and other substitutes for metals difficult to obtain in Germany owing to exchange restrictions, and some of these were shown at the Leipzig Spring Fair held from March 6th to 14th.

The firm of C. and E. Fein, Stuttgart, showed a range of 80-W hand-drilling machines, designed for minimum weight, with two standardised grips specially designed for convenience in operation without fatigue and with tips which can be put on to drill at an angle or square to the shaft. The same firm showed a 250-W hand-drilling machine, an electrically driven hand circular saw, a tool post grinder and an electro-pneumatic hammer for riveting and chipping in various sizes. The use of aluminium and "Elektron" not only lightens the parts, but also makes it more possible to use die-castings.

The A.E.G. displayed the "Eltas" size-measuring device, so arranged that the air-gap between two iron-cored coils is varied when the piece of work departs from the correct size. The two coils lie in two arms of a bridge circuit. The apparatus is quite suitable for workshop use and is arranged so that a difference of length of 0.01mm. gives full-scale deflection of the indicating instrument. The apparatus contains no amplifiers, and voltage variations are automatically compensated for. The same apparatus is used on the profile milling machine shown. Another profile miller (Keller system) is shown by Siemens, in conjunction with Collet and Engelhard and with Heyligenstaedt, Giessen. In this, pressure of the model on the feeler makes contacts which start the traverse of the cutter. Undue pressure on the feeler closes other contacts which stop the traverse. The Brown Boveri Co., with Collet and Engelhard A.G., showed a profile miller working direct from drawings by the use of two photo-electric cells, no models being required. The machine exhibited was suitable for ships' screws and similar difficult contours.

Novel Fret-saw Machines

The A.E.G. showed two fret-saw and filing machines for use on a.c. mains, developments of the "amateur" saw shown previously. The fret-saw blade is driven by diaphragms which vibrate the blades up and down 6,000 times a minute. The smaller of the new saws, with double the capacity of the "amateur" saw, consumes 75 W and cuts soft woods up to 35 mm. or aluminium up to 1½ mm., and is suitable for intermittent use only. The larger consumes 100 W and is suitable for continuous use, it cuts soft woods up to 42 mm. and aluminium up to 3 mm. The saw has two membranes. The upper one has a little pump on it which blows a constant blast of air over the saw to remove the cuttings. The stroke of the saw can be altered by turning a knob on the machine and the table is adjustable for height by a scale and pointer enabling the saw-blade to be used along the whole length. It is also provided with a light.

The A.E.G. second-measuring meter has an accuracy of ±20 milli-seconds; it has a constantly revolving synchronous motor, clutched at the beginning of the timing operation and unclutched at the finish. The instrument has been used for timing relays, measuring the velocity of bullets and the speed of explosives, for timing photographic shutters and for sporting purposes.

Voigt and Haeffner showed a new glue pot with two heats and the A.E.G. a new style soldering iron. The Sachsenwerk electric drive for machine tools has a frequency transformer for 500 cycles which supplies current to a special 3-phase motor running at 30,000 r.p.m. Siemens showed in a tapping machine a 3-phase squirrel-cage motor specially designed for up to 7,000 reversals per hour, with a rating of 0.3 kW at 1,500 r.p.m.

Brown Boveri and Co. exhibited an improved independent time-limit relay with a delay variable between 0.2 and 10 secs., with an accuracy of ±0.05 sec. and also an entirely new thermal relay. They also showed a new portable relay testing transformer giving an output with smooth variation between 5 and 2,500 A by means of a stray field transformer. The A.E.G. also showed a number of new relays.

Large Three-phase Switch

Sachsenwerk had a new kind of 3-phase switch with small oil tanks for internal installation for 600 MVA nominal rupturing capacity. In order to obtain the biggest possible distance between the phases, the breakers are placed at the three corners of a triangle. Brown Boveri showed water-tight switch cases and junction boxes, particularly useful in the tropics, made of non-corroding alloys of aluminium and magnesium.

The firm Julius Pintsch, of Berlin, showed a voltage regulating transformer with a winding with tappings which are brought out to a contact track, over which slides a metal brush. The voltage between adjacent contacts is between ½ and 1 V, so that regulation is practically stepless. By the special arrangement of the iron core and windings, the flux in the short-circuited section of the windings is reduced so that the short-circuit current and sparking are reduced. It is built for voltages up to 550 to handle up to 600 A with a regulating capacity of 30 kVA.

The A.E.G. exhibited a dimming transformer to enable barracks, public buildings, &c., to dim all lights in case of an air raid from a central point without altering the lamps. Experiment has shown that if the mains voltage is reduced to 52 V the amount of light is sufficiently reduced so that lamps can be left burning and essential work carried on. It is possible to see around the building, but drawing of blinds, &c., is not necessary, so saving considerable expense and much valuable time. The apparatus also provides means for extinguishing completely advertising signs, &c. Nostitz and Koch, Chemnitz, also exhbited dimming transformers operating by decreasing the voltage. Sachsenwerk had a range of sirens for air-raid warnings and other purposes, with loadings between 120 W and 5 kW.

Generators and Convertors

Dr. Max Levy G.m.b.H. showed a 3-phase dynamometer generator for testing motors, &c., which enables energy to be returned direct to 3-phase mains, enabling 70 to 90 per cent. of the output to be saved as against less than 50 per cent. for a d.c. load generator used with a convertor. The same firm also showed convertors for running neon signs from d.c. mains, the machine being provided with several sets of slip rings to feed two or three independent circuits. The Brown Boveri Co.'s welding convertors for 50 to 350 A now uses a metal rectifier for excitation instead of the separate rotary exciter previously used. Lohr and Sohne included new motors up to 3 kW with frames, &c., of "Elektron."

Sachsenwerk showed new standardised cast-iron watertight power plugs and sockets for works use, triple-pole, 15 to 100 A. The sockets, plugs and transformers are interchangeable between the various designs. The A.E.G. displayed a new model magnetophone, with remote control and arrangement for recording telephone conversations, and a new dynamic microphone. To facilitate the typist's work, the records can be played back with either headphones or loudspeakers.

The Siemens exhibits included an interesting call system for hospitals and hotels, using light methods and new street lighting reflectors for central suspension. The same company showed meter figure drums built up from aluminium instead of die-cast, with the object of reducing weight and consequent meter errors.

The Brown Boveri Co. showed a new model of the "Elektrant," a small tower to fit into a man-hole and supply current in places like aeroplane hangars, where there must normally be no excrescences.

Domestic Equipment

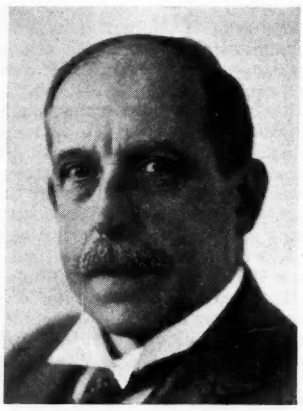
Almost all the apparatus displayed is designed to be free from interference with wireless. Owing to a reduction in rates for day consumption of electricity, the use of small water-heaters of 1 to 2 gall. capacity is becoming more popular German manufacturers are making a special selling point of the greater safety of electricity than of gas.

The Brown Boveri Co. showed a new water-heater with a glass tank. The advantages claimed are that the water takes on no taste from the tank and so can be used for drinking, the glass is free from corrosion from any type of water, and furring is reduced. Synthetic rubber, which does not perish with heat, forms the junction between the tank and the base. The same advantages are claimed for the water-heaters made by Siemens-Schuckert and A.E.G., which have porcelain tanks. Ehrich and Graetz have supplied over a thousand 16-gall. water-heaters with glass interiors to the order of the Berlin Electricity Works. The A.E.G. low pressure water-heaters of 16, 20 and 24 gallons are provided with a lead-off at about two-thirds of the height of the tank, which can be used for providing respectively 4, 6 and 8 gallons for use at the wash-basin or kitchen, whilst the water underneath is provided for the bath. The same firm has also a range of heaters with two elements, one of which can be used for ordinary purposes and the larger one only when there is a sudden demand for large quantities of water.

A new A.E.G. cooker has front and side walls of hard porcelain instead of enamelled iron. The switchboard and oven door are of porcelain, the back and floor of asbestos cement.

The Passing of a Switchgear Pioneer

IT is with great regret that we announce the death of Mr. H. W. Clothier, following an operation in Auckland, New Zealand, where he happened to be in the course of an extensive private and business tour in that part of the world. Mr. Clothier's principal work was done in his long association with A. Reyrolle & Co., Ltd., of which company he was a director. He retired from some of his executive activities in April, 1937, but continued to act in an advisory capacity on the work he had previously controlled. This change freed him for the tour on which he was engaged. Mr. Clothier was born in London in 1872, and after an apprenticeship and some subsequent work with J. & H. Gwynnes, Hammersmith, he was for about ten years first with the late Dr. S. Z. de Ferranti and Mr. S. P. Sparks in London, and then at Hollinwood in charge of many matters connected with the design of Ferranti's switchgear and transformers. In 1905 he went to Tyneside to begin an investigation of protective gear for electric power generation, transmission, and distribution systems at the suggestion of Mr. C. H. Merz and Mr. B. Price. While thus engaged, his attention was directed to the improvement of high-voltage switchgear, and he then produced the original designs of the metal-clad draw-out type. In 1906 he joined the staff of A. Reyrolle & Co. to supervise and direct their switchgear developments. His unceasing advocacy of the need for continuity in the supply of electricity and for safety of human life in its use has borne much fruit. His close connection with the activities of other companies—Holmes, Parolle Electrical Plant, and Pyrotenax—is well known, and his various Institution papers form a record of some of the things that he was always saying and working for.



The late Mr. H. W. Clothier

To Mrs. Clothier, who was with him in New Zealand, and to the other members of his family we extend our sincere sympathy in their loss.

An Appreciation.—Although of a younger generation, I had known Clothier for nearly thirty years and was the last to bid him farewell when he sailed last autumn to revisit his many friends in Australia, New Zealand and South Africa. He was full of boyish enthusiasm, delighted with the models of the latest power-station switchgear he was taking to illustrate the I.E.E. paper he was to read overseas. His retirement from executive work last spring had made no difference to his interest in his life work, and his first use of freedom was this visit to spread the metal-clad gospel.

Like Parsons, he was one of that small band of engineers who, as young men, developed a new technique, and after strenuous work have had the satisfaction of seeing their ideas generally accepted in this country. He was also very active in extending its use to America and the Continent. Tyneside at the beginning of the century was the pioneer field of electrical engineering, and Clothier played his full part, of which he has left a permanent record in his collected papers, "Switchgear Stages," published privately five years ago.

Somewhat slow and serious in manner, he was untiring and pertinacious in wearing down prejudice and opposition, yet was liked and esteemed by all. Always a welcome visitor himself, one of his greatest delights was to conduct his many friends round the ever-expanding works and show them his beloved metal-clad switchgear, increasing in voltage and rupturing capacity to 132 kV and 2½ million kVA. In later years his special pride was the first switchgear short-circuit testing station in this country, the establishment of which was mainly due to his foresight and initiative. These visits and his talks on new developments, illustrated with broad-nibbed fountain-pen sketches, will be remembered by many, as also will be the narrow margins by which he caught his trains. A keen swimmer, he played water polo for many years, and received the Royal Humane Society's medal for a most gallant rescue from the Tyne.

No national or international technical gathering was complete without his presence, and he enjoyed their social side. He did valuable service for the I.E.E., both on the Council and in the North-Eastern Centre. He worked keenly for standardisation and research and had a high ideal of public duty, which extended to municipal work on Tyneside, while a deeply religious background to his character led him to take an active part in Church affairs. His happiness in his home and family was delightful, though clouded by the early loss of his first wife. In later years he added to a most happy second marriage a special attachment to an increasing bevy of grandchildren.

J. R. BEARD.

The Leipzig Fair *(Concluded from preceding page)*

The frames have had to be reinforced since the porcelain does not give strength to the oven. The internal walls of the oven are of welded steel. Models 38 and 36 are provided with cast hot-plates involving special utensils, while "Model 37" has new radiant hot-plates which are expected to be popular, since no special utensils are needed. The same firm showed table cookers made with oxidised aluminium bodies.

Ehrich and Graetz use enamelled iron weighing 0.7 kg. for the frames of their boiling plates, where cast iron frames weighing 3.1 kg. were used before. The Brown Boveri Co. has reduced the weight of its cooker hot-plates to 60 per cent. of the previous figure by careful research, without reducing their life and with correspondingly quicker heating.

Wilhelm Hilzinger, Stuttgart, exhibited a number of grills for home and restaurant use, between 600 W and 2,400 W. One of the larger ones is arranged with a spit to take two chickens, the spit being revolved by an electric motor. The same firm displayed new bakelite-framed toasters in attractive colours and a toaster for four slices of bread, designed on novel lines. Voigt and Haeffner showed a new toaster with a simple automatic turnover device.

Waffle irons were shown by every manufacturer. Eltron, of Berlin, have produced an immersion heater in a neat hard porcelain jug; the immersion heater, though neatly fitted, is readily removable.

Siemens-Schuckert "Rapid" and "Junior" suction cleaners had new motors with increased suction capacity in sealed "Elektron" casings with effective cooling and mounted on rubber for noise reduction. The "Protos" super-suction cleaner has a more flexible hose and a ball-and-socket hose joint at the bucket. The number of accessories is increased and a wall rack to hold them is provided.

Double Heating Control

The A.E.G. showed a room-heating plant in which, instead of the usual boiler, an electric circulator is used, in conjunction with a thermal storage tank, for night-heating. The circulator has two groups of heating elements, of which one is controlled by a thermostat in the open air and is only switched on when it is cold outside, the other is controlled by a variable thermostat in the room. The heaters in the room have adjustable shutters, so that different rooms can be kept at different temperatures if desired. Any ordinary central heating system can be changed over to full electric heating quite easily. A.E.G. also showed new 1-kW and 1½-kW heaters provided with fans and a new fan combined with a humidifier.

Voigt and Haeffner displayed a new "Prometheus" iron with a three-heat switch and 1,000-W loading, so that it can be made light, not needing thermal storage. Ehrich and Graetz use enamelled iron for domestic irons and iron covered with polished aluminium on both sides, which has good appearance and anti-radiation characteristics. Siemens showed a new lightweight hair dryer of new design; the A.E.G. a lightweight model of coloured metal; and Wilhelm Hilzinger electrically warmed foot-mats.

Electrical Propaganda in New Zealand

We have received from Turnbull & Jones, Ltd., electrical and mechanical engineers, of Wellington, N.Z., particulars of an interesting scheme for promoting sales of electrical apparatus in New Zealand. In October last year a quest was commenced by the National Commercial Broadcasting Service to to find a Wellington "Deanna Durbin," and Turnbull & Jones, in company with several other concerns, offered prizes to the winner. So great was the interest shown in the scheme that it was decided to hold a New Zealand-wide quest and Turnbull & Jones, Ltd., sponsored it. There were contests at Auckland, Wellington, Christchurch and Dunedin. In each centre the company's local branch arranged for the winning competitor to sing in the showroom before leaving to compete for the title in Wellington. The local commercial stations conducted their broadcasts from the company's showrooms, and the public attended in such large numbers that the overflows had to be catered for outside by means of loudspeakers. The company tells us that the effort had a very beneficial reaction on its business.

Higher Steam Pressures and Temperatures

By a Special Contributor

The author deals with the effects of mechanical research on power station practice

ALL sections of the electrical industry have, during the past twenty years, contributed very largely towards the expenses of research work carried out under the ægis of the British Electrical and Allied Industries Research Association. Probably regular readers of the ELECTRICAL REVIEW will be fully aware of the benefits which have accrued to the industry through electrical researches, but they may not be so well versed as to the gains which the industry has received from the mechanical researches sponsored by that body.

When one compares the power station of to-day with that of twenty-five to thirty years ago there are two main changes which attract our attention. The first and most obvious is the great increase in the size of generating units. In the early days a power station consisted of a large number of small engine units all set neatly in a row and generally progressing in size, so many of one capacity followed by so many of perhaps double the size. Such stations were then impressive by the number of units and their orderly arrangement. The still earlier stations before the days of vertical high-speed engines were not always impressive from the point of view of orderliness. In a modern power station the units are very large, few in number and imposing by their very magnitude.

In the mere increase in size there is perhaps nothing very remarkable as it is only a natural development in every direction. This increase in size is, however, accompanied by an increase in efficiency, reduced cost per kilowatt installed and also reduced labour charges.

The other outstanding change in the power station from the mechanical operating side is the steaming conditions. Between 1905 and 1910 engineers adopting a steam pressure of 200 lb., 200 deg. F. of superheat and a vacuum of 28.0 in. were quite up-to-date. This gave a total steam temperature of 588 deg. At the present time many units of 30,000 and 50,000 kW are being installed for a steam pressure of 600 lb. and a total temperature of 850 deg.

These conditions are not the highest that have been used, as a British built turbine in America is designed for and runs at a temperature of 1,000 deg. F. and there are machines running in England at pressures of 1,200 and 1,400 lb. per sq. in. For a power station in the North of London plant is now under construction designed for a pressure of 1,900 lb., superheated to 932 deg. F. Steam is being supplied by boilers of the Loeffler type. Another large power station in London has now on order a unit for a pressure of 1,500 lb. and the same temperature of 932 deg. F.

Increased Efficiency Ratio

The increased total heat per lb. of steam resulting from these higher temperatures and pressures would not have any affect upon the coal consumption, unless the efficiency of utilisation improved with the higher steam conditions. It would, apart from this, merely reduce the weight of steam required to convey a given amount of energy from the boiler to the turbine.

But an increase in the steam temperature does entail a greater efficiency of utilisation in the turbine, as the ideal or theoretical efficiency of any simple cycle thermal engine is proportional to the difference between the inlet temperature and the temperature at which the unusable heat is rejected. The latter temperature is determined by the attainable vacuum and this in turn is fixed by the circulating water temperature. The minimum temperature, therefore, of the cycle of operation is fixed within small limits by natural circumstances. Hence, practically all improvement has been sought in an increase in the inlet temperature of steam.

As an example, a pound of steam at 600 lb. gauge and 850 deg. F. contains only 9 per cent. more total heat per pound than steam at 200 lb. gauge and 588 deg. F. The heat available, however, for use in a turbine or the adiabatic heat drop with a vacuum of 29.0 in. is, for the former conditions, actually 29.4 per cent. greater than for the lower conditions, thus indicating the increase in the possible efficiency of utilisation.

But while this upward move in operating conditions has been proceeding turbine designers have been simultaneously improving very considerably the efficiency of the turbine nozzles and blades and so are able to convert into power at the turbine coupling a much greater percentage of the available and usable heat contained in the steam at the inlet to the turbine.

Extensive research on blading and nozzle proportions has been carried out by E.R.A. jointly with the Institution of Mechanical Engineers, and it has undoubtedly resulted in a very appreciable improvement in blading efficiency and, in fact, has entirely modified the design of steam turbines.

The growth in size of units has facilitated the use of higher steam pressures which are necessarily associated with higher steam temperatures and in turn the higher pressures have rendered the larger units more practical propositions. To design turbines and other components for high pressure steam at or near to saturation temperature would not be difficult but the associated high temperature calls for very special attention.

Growth and Creep

The increase in the temperature of steam brought to turbine designers a very great problem although the advance in temperature has been slow. In the early days it had been found that even with very moderate temperatures the linear dimension of cast-iron turbine cylinders increased perceptibly over a period of years. This trouble was comparatively easily overcome by the use of steel castings for all portions of a turbine subjected to a temperature of 450 deg. F. or upwards, and for a time no further trouble was experience. When, however, the temperature gradually increased to 700 deg. then, perhaps by steps of only 25 deg. up to 800 and finally up to 900 or even 1,000 deg. trouble was experienced. It was found that stress and strain were no longer strictly in proportion or, to express it another way, that the modulus of elasticity was no longer constant but varied with time when the material was stressed even comparatively lightly and was operating steadily exposed to high temperatures. The material thus became plastic and under certain constant loading conditions the strain increased with time until fracture occurred. Thus arose the problem referred to as "creep." The determination of the rate of "creep" at different stresses and under various operating conditions is an investigation that has involved numerous long duration experiments not yet completed.

A large number of these experiments have been and are still being made at the National Physical Laboratory, Teddington, and others have been made in some of the research laboratories belonging to turbine manufacturers. A tensile test piece is maintained under a constant stress and is kept at a uniform temperature by a surrounding electrical heater, thermostatically controlled. This temperature for different test pieces of the same material will vary up to perhaps 600 deg. C. These conditions are kept constant for 2,000 hr. or longer and the extension is noted periodically or automatically recorded. A single test has been continued for a period exceeding 25,000 hours or about three years.

It is found that for a particular temperature and stress the length of a test piece gradually increases or "creep" takes place. Eventually rupture occurs, the time taken depending upon the temperature and stress for the same material. Thus, the higher the temperature the lower the stress that will cause fracture in a given fixed time.

Selecting Initial Stress

If the part under discussion is not one that is periodically removed from the turbine and retightened on replacement, then it is necessary to select the initial stress so that under the operating conditions of that part the strain will not exceed 0.001 in, say, 100,000 hr. This strain in 100,000 hr. is generally accepted as a suitable limit as it is probable that new plant now installed in a power station will be obsolescent in that time. This is nearly 11½ years assuming that the plant is running continuously, but allowing for normal stoppages even for a favourite unit in a power station this period would probably correspond to a working life of about 15 years.

The cylinder bolts of a high-pressure turbine cylinder using steam at 850 or 900 deg. get extremely hot and are, therefore, subject to "creep." If the creep continued the bolt would so lengthen that it would no longer be effective. Therefore the initial stress on these bolts has to be so selected with regard to the temperature attained during operation that during the period between the opening of the turbine for overhaul, the bolt does not increase in length by more than a certain fraction of its length, or in other words the strain does not exceed a certain value.

Very useful alloys are the molybdenum steels and also chromium molybdenum and nickel molybdenum steels. In addition to withstanding as high a stress as possible at these high temperatures the steel must be such that it has a stable surface, or in other words that it is not an easy prey to corrosion under the severe operating conditions.

The turbine designer became aware many years ago that the properties of steam at high temperatures and pressures were not known with sufficient accuracy. Originally all steam engineers depended upon the Regnault tables and until Callendar commenced his research work on the properties of steam some thirty years ago the Regnault tables were practically the only authority. Since that time investigators all over the world have been exploring this most interesting field of physical research. As a result steam tables were published in different countries and although they were all dealing with identical material, steam, the results obtained varied to a surprising extent.

International Co-operation

In 1921 the E.R.A. approached the American Society of Mechanical Engineers, which was then proposing to sponsor a complete investigation into the properties of steam. Out of this approach arose the International Steam Tables Conference, of which the members are Germany, U.S.A., Czechoslovakia and Great Britain. In these four countries competent investigators were dealing with this question and conferences were held in London in 1929, Berlin 1930 and New York 1934. At each conference a skeleton table of the properties of steam was produced, there being attached to each figure a tolerance of sufficient magnitude to cover practically all the experimental results of the different investigators. At each conference the skeleton table grew, the intervals between the tabulated quantities being reduced and the tolerances also decreased. That conference has recommended that only those steam tables whose figures come within the tolerance attached to any figure in the skeleton tables should be accepted and regarded as an authoritative steam table. This work in the various centres has been extended up to 4,000 lb. per sq. in. so that the physical knowledge required by the turbine designer is now, or will shortly be, available with great accuracy up to pressures and temperatures in excess of that which the turbine builder is now able to use.

Progress in the improvement of the thermal efficiency of steam turbines is dependent upon the joint efforts of three separate groups or teams, the turbine designer, the metallurgist and the physicist. The physicist has now nearly completed information for operating conditions more onerous than those for which the metallurgist is able to supply suitable material. The turbine builder is able to utilise fully the more accurate knowledge regarding the properties of steam. The metallurgist is now providing superior materials, but further progress is required from the metallurgist before any great advance can be made in the efficiency of steam turbines. If such improved materials involve a great increase in the cost of steam turbines and boilers, then it is a very moot point whether such development would be commercially advantageous to the final user, *i.e.*, the consumer of electricity. That, however, leads away entirely from the question of the benefit of research into a very mixed commercial domain.

Station Operation Difficulties

The use of these high temperatures renders the operation of a power station more difficult or, perhaps it should be said, involves the staff in certain precautions which were hardly necessary in the early days of turbine operation. When a turbine is supplied with steam at 850 or 900 deg. F. the whole machine naturally heats up until there is a steady, but not necessarily uniform, temperature gradient from the inlet to the exhaust, and the design has to be such that each portion of the turbine can adjust itself to the prevailing local temperature without introducing any mis-alignment or undue stress.

The methods adopted for this consist mainly of a definite anchorage at some point in the turbine, usually a bearing on the low-pressure cylinder. Transverse keys on the bearing pedestal anchor the latter to the bedplate and so to the foundations in a rigid manner. The other bearings are provided with axial keys which allow the bearing pedestals to move axially as required to allow for the expansion. The cylinders themselves are also keyed to the bearing pedestals so that the cylinder expansion is transmitted to the bearing which then moves on the axial keys. It is necessary, of course, to preserve the concentricity of the cylinder and rotor, and this is done by a principle which may take different forms.

At one time the supports of a high-temperature cylinder on the bedplate were raised so that their working faces were in a horizontal plane through the centre line of the spindle. Obviously it is equally effective if those faces instead of being in the horizontal plane are each in an inclined plane passing through the centre line of the spindle. The cylinder is still free to move axially, as indicated previously, and any tranverse expansion would still leave the centre line of the cylinder concentric with the axis of the spindle. There might also be a vertical key between the bearing pedestal and the cylinder on the centre line of the spindle.

This arrangement is quite effective and on large units a total expansion in length of perhaps one inch is easily accommodated. When a large unit has been properly and slowly started up from cold, the load may be varied repeatedly without any undue effect, but it is essential that the heating up should be done slowly. Wonderful claims are made for the rapid heating abilities of special designs of turbines but slow heating is desirable.

These remarks apply particularly to turbines which are not operating with re-heated steam. The more complicated the operating cycle and the more onerous the conditions, the more necessary would it appear to be to maintain the load fairly constant, particularly when the steam is re-heated. A turbine working on a re-heat cycle would find the best scope for operation in a base load station of a large system in which it may be kept loaded practically at any desired percentage of its maximum capacity without appreciable variation.

Condenser Tube Corrosion

In the researches into the performance of condensing plants that have been sponsored by the E.R.A., the two main problems that have been attacked are, first, the circumstances under which heat is most easily transmitted from the steam to the water inside the tubes of the condenser, and, secondly the means by which tubes can be rendered immune from the corrosive attacks of certain waters which are necessarily used for circulating purposes. The heat transmission question has been investigated at very great length and, as a result, interested manufacturers have available very complete information as to the effect upon performance of varying any one of the very large number of factors which do affect the performance of surface condensers.

The investigation into the corrosion of condenser tubes is being made jointly with the British Non-Ferrous Metals Research Association, and the work, although it has been in hand for a long time, is still unfinished, owing to the enormous number of factors, not only mechanical but also commercial, that have to be brought under review. Considerable progress has been made, however, and it is possible now to select for any particular installation a tube that will be reasonably free from corrosion.

Maximum Overall Cash Efficiency

A point worthy of further discussion, although freely discussed in the past, is the extent to which it really pays to adopt operating conditions which are more onerous and involve a more expensive plant. A mere decrease in the quantity of heat used per kWh generated has no commercial significance. Only when the overall station cost of generating a kWh is reduced is there any advantage in adopting these more onerous conditions.

In the past the efficiency of generation has been ever increasing, but it is rising on an asymptotic curve and there would not appear to be much more room for improvement in the turbine, where we see the effect of the law of diminishing returns. There is still room for improvement in the cost of transmission and distribution, as that section of the electrical field is working on a very much lower portion of the asymptotic curve mentioned above. Here, however, one departs from technical research and enters into questions of commercial operation or perhaps political activity. But one cannot close without mentioning the reduction in cost of distribution arising from the work of the E.R.A. on the heating of buried cables. Can it produce another advance of like import?

Without co-operative research through a body like the E.R.A. many of these advances could not have been made, as no one firm is engaged in the industry on a scale that would allow so many lines of comprehensive research to be followed so thoroughly and continually. We get good value for our contribution to research.

Welding Possibilities

In the course of a recent discussion on the design of structures for welded fabrics at the Junior Institution of Engineers in London, it was explained that arc welding was introduced as a means of cheapening manufacture and repair work. Not more than 15 per cent. of the known applications were being employed, however, and a large field which had not yet been thought of awaited development. Welding was likely to play such a large part in manufacturing processes that a knowledge of it would be essential to the engineer and the managing executive. It might eventually employ more capital and labour than the steel industry.

Meetings and Discussions

The influence of the grid on transformer size was one of the points dealt with by Mr. R. M. Charley in a recent lecture to the South Wales branch of the A.M.E.E. Developments in the design of power rectifiers were discussed in a comprehensive paper read at the I.E.E. yesterday (Thursday) by Dr. W. G. Thompson, who attributed the sustained importance of d.c. engineering to this cause. In the discussion on Mr. W. J. Jones's I.E.E. paper last week the effects of tariffs upon the development of the lighting load received the greatest attention. In a recent Junior Institution lecture on water turbines, Mr. W. A. Kennelly made a useful survey of the various types.

Large Transformers

A LECTURE on "Modern Transformer Practice" was given by Mr. R. M. Charley last Saturday before the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, South Wales Branch. It was the initiation of the grid system, the lecturer said, that gave the real impetus to the manufacture of large transformers, and since the first units were put into service on the grid in 1929 about 10½ million kVA of transformers had been purchased by the Central Electricity Board. The total is made up of 7½ million kVA at 132 kV and 3 million kVA at 66 kV and lower voltages.

Prior to that year comparatively few transformers had been equipped with on-load tap-changing gear, but practically every transformer on the grid had been provided with such equipment. In addition to this, about 7 million kVA of other transformers with on-load tap-changing gear had been built, making a total of 17½ million kVA. Conditions in this country had not yet demanded a transmission voltage above 132 kV, but a number of units for operation at 154 kV had been built for export.

The design of a very large transformer presented greater mechanical than electrical problems, and facilities for cooling and provision against mechanical forces produced under short-circuit conditions were closely related. Where adequate water supply was available artificial cooling with a separate water-cooled cooler and forced-oil circulation was quite sound and economical.

Power Rectifiers

THE present state of development of mercury arc rectifiers is surveyed in the paper by Dr. W. G. Thompson (General Electric Co., Ltd.) that was read at an additional meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 17th.

Recent innovations in design and some limitations are discussed. The various types (water-cooled, glass-bulb, pumpless air-cooled steel-tank and igniter) represent a voltage range from 200 V to 50 kV d.c. and outputs up to 10,000 A; but reference is also made to some of the non-vacuum types (jet-wave, gas-cooled arc, electrolytic and mechanical), most of which are still in course of development.

The author has little doubt that rectifiers have been responsible for sustaining the use of d.c., thus providing flexible control combined with the economies of a.c. distribution; they have also greatly influenced traction methods. While the author does not seem to expect much further change in essential features, one limitation has been removed by the recent building at Witton of plant capable of testing rectifiers up to 6,000 kW at up to 4,000 V, and equivalent tests corresponding to loadings at 12,000 kW are possible.

Dr. Thompson suggests that air-cooling, even for larger sizes, will eventually be adopted and that the vacuum pumps will inevitably disappear as a unit feature of each rectifier.

With high voltages the demand has proved smaller than anticipated; radio broadcasting, rather than d.c. transmission, would appear to be the limit of requirements. So long as the transmitting-valve policy remains as at present there will be little demand for rectifiers above 20 kV. The future of the lower-voltage working is bound up with the question of arc drop, and in this connection the use of single cylinders per anode and also the jet-wave rectifier appear to have brought us to a lower limit than was previously economically possible. There is little doubt that the great outlet for power rectifiers will remain the 500/3,000-V range, in which sphere not only has confidence been established but also their application has resulted in considerable saving to the community as a whole.

Over four million kW of rectifier plant is in operation throughout the world. The demand has been steady and progressive, and shows no immediate signs of diminution. The air-cooled all-metal design and the igniter types represent the most recent progress in their respective fields.

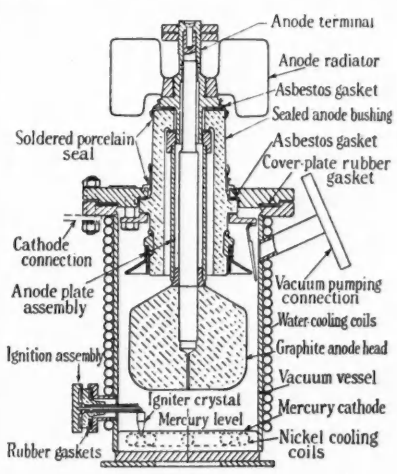
Grid control as a means of voltage regulation has proved less popular than was thought probable a few years ago. Some of the theoretical possibilities have not materialised and there have also been limiting economic factors to other forms of controlled operation.

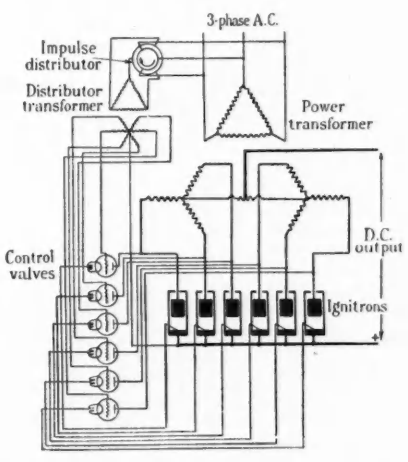
The so-called grid control has been applied for retarding the striking of the power arc in the rectifier until a desired moment in each half-cycle. The igniter type, however, embodies the reverse process, and positive means are taken to ignite the arc at the desired moment with respect to the a.c. wave. In general the common cathode types are more particularly suitable for continuous heavy-current working, but as a result of the voltage/current characteristic the maintenance of the cathode spot at light-load periods has to be assisted by auxiliary anodes.

Commercial Designs

Most of the non-vacuum rectifiers are merely synchronous interruptors and are free from polarity limitations, but generally involve numerous auxiliaries or rapidly moving parts. On the whole their efficiency, reliability, and economy, are lower than those of the mercury-vapour devices.

It has been found possible in most of the non-vacuum rectifiers to produce the analogous effect to "grid control" featured in the mercury-arc rectifiers. The action is usually of a positive type, since the initiation of the conducting period is dependent upon auxiliary means and not upon removal of the screening effect of the grid. It is only necessary to advance or retard the timing of the auxiliary ignition device to produce the corresponding change at starting of the conducting period in the working portion of the cycle. The mechanical inertia associated with the moving parts of these types of rectifier does tend to produce commutation difficulties, especially when attempting inverted operation. Partly for this reason the application of an auxiliary supply to give so-called harmonic commutation has been put forward.





Left: Single-phase "Ignitron" rectifier. Right: Main and auxiliary circuits

Hot-cathode rectifiers (mercury vapour glass valves) have been made with outputs up to 275 A at 7,500 V, and for X-ray purposes of several hundred mA at 100,000 V. For anode circuits in woreless stations they are made to give from 500 mA at 1,000 V up to 20 A at 20,000 V.

Arc rectifiers (mercury pool) have been made with eighteen or more anodes, but rather for reducing the intensity of the anode loading than to obtain an enormous output from a single cylinder. Where space is limited the grouping of smaller and simpler units is often preferred to one large set with more elaborate auxiliaries. Improved ventilation has made glass

bulb types of 500 A d.c. possible. A mean of 200 A per anode has been suggested as a safe working value. By grouping bulbs in parallel sub-station capacities up to 6,500 kW have been obtained. Glass bulbs have been made to operate at up to 20 kV (10 A, with nine arms, six in use at one time).

The lower economic limit of the water-cooled steel-tank class is 1,000 A. Ratings up to 6,000 A are reliable and, should the demand arise, 10,000 A d.c. could easily be obtained from a single tank; but it is admitted that the rating of 16,000 A mentioned a few years ago has not proved advisable. Large tanks involve longer arc paths and greater losses. These rectifiers can be made to work up to 50 kV, but only by drastically derating the current output.

Pumpless air-cooled steel-tank rectifiers are made for from 250 to 750 A, though 1,000 A has been obtained under test and a 20,000-A short circuit has been applied without ill-effects. Most of this type in use are for 500 V d.c., but it is suitable for 3,000-V operation if desired.

The sectionalised layout used in America, with self-contained cellular units connected in parallel, has made little headway in Europe. But the author suggests that the pumpless design has altered the position and might well be applied on the sectionalised system to increase efficiency and save considerable weight and space.

The "Igniter"

So-called "ignitron" rectifiers are of recent development. A polyphase make-up is an assembly of single-phase units, each provided with an igniter rod of semi-conducting material, such as boron carbide (silicit) inserted permanently in the mercury. At the instant of ignition the ignition circuit receives a current impulse, and the resulting voltage field, produced by the concentration of the current at the junction of the igniter rod and the surface of the mercury, is sufficiently intense to give rise to a cathode spot which allows the power arc to form. Actually, the time-lag on the formation of the main arc is less than 100 microseconds. The ignition principle is remarkable in many ways; it is, for example, still effective at − 200 deg. C., though it does not follow that a stable arc is produced at very low temperatures. The slotting of the igniter electrodes gives a reduced starting current at a slightly higher voltage. The ignition is timed with the aid of small grid-controlled mercury-vapour rectifier circuits, and these would be conveniently excited from a synchronously driven induction generator. The ignition is dependent upon the functioning of the continuously running auxiliary valves.

The sealed-off type has been made in units up to 250 A and general use is made of the 75/100-A (mean) sizes, for which the output does not warrant the cost of a pumping system.

The chief attraction of the welding application is the controlled time intervals through which the current can be allowed to flow. Single-phase half-cycle welding units have been constructed for 500 V and with peak densities up to 500 A per sq. in. The small sealed-off welding ignitrons are made with both glass and water-cooled metal containers. Outputs up to 7,000 A (peak) have been obtained from a group of ignitrons, corresponding to about 100 A (mean) per valve.

The use of separate vacuum vessels for each anode-cathode pair means that there is an absence of ionised vapour between the electrodes during the reverse half-cycle, so that a close electrode spacing becomes possible. Advantage can be taken of this fact to produce low-voltage polyphase ignitron rectifiers with about 13.5 V arc drop at 300 V where shielding can be largely dispensed with. As a result of this, it is possible to apply this type of apparatus economically to a.c. voltages as low as 200 V. Incidentally, ignitron rectifiers have been operated at 16 kV with the current reduced to 5 A.

The extent to which grid control has been applied in practice has fallen considerably short of the experimental and theoretical possibilities. It involves such practical aspects as stability of the control gear, cost of the electrical filters necessary to cope with the large amplitude harmonics produced in the voltage output wave, and poor power factor when operating at reduced voltage under grid-control conditions.

On paper there are many attractive forms of grid control to produce certain desired characteristics, and many methods of frequency changing, but in actual practice it would appear that this application may be limited to the voltage regulation of rectifiers, inversion in connection with regenerative breaking, and arc suppression.

Lighting and the Supply Authority

HOW more liberal illumination and modern methods of lighting affect the demand for electricity and revenue obtainable, as outlined in the paper by Mr. W. J. Jones, which was referred to last week, was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 10th.

Mr. J. W. J. Townley detected a critical aspect of the paper, and therefore, in defence of supply authorities, he maintained that policies which aimed at the quickest return could be justified. He could not agree entirely with some of the author's figures. For example, he would say most emphatically that small working-class consumers were not economical unless at the same time they used electricity for incidental purposes. For instance, in some cases the energy used for radio might equal that employed for lighting. There was no need for the author to weaken his case by including inaccuracies.

Many small consumers, he said, would willingly increase their consumptions if they could afford to do so. If the various marketing boards and similar efforts succeeded in inducing the working classes to spend more on food, they would have less to spend on electricity. Their purses were very limited, and it was necessary to prevent a single lamp from being moved from room to room. Consumption could be increased by 20 per cent. if the maintenance scheme were so arranged as to include the provision of lamps for all sockets. Another useful method was to lend the showroom window to local traders as a means of demonstrating how their goods might be displayed to better advantage. It was difficult to obtain better street lighting in some localities because it would mean additions to the rates. One way of overcoming this difficulty was to induce the local Council to permit an experimental scheme on the understanding that it could be removed if so desired. Having experienced these better results the public would never return to the old conditions.

Mr. A. Cunnington, speaking from the consumer's point of view, said that so far as the Southern Railway Co. was concerned 20 per cent. of the stations were now electrically lighted as compared with 3 per cent. formerly; within 50 miles of London, 40 per cent. were electrically lighted. This change-over had been entirely on economical grounds. There was no predisposition to use electricity, which had proved to be cheaper, and they had had no assistance from the supply authorities. Only when he asked for help did he receive it.

Tariffs were all-important and must be favourable. Railway lighting was a long-hour load, even longer than the domestic load. The two-part tariff could be made still more useful if it could include small heating and similar uses in signal boxes and stations. Tariffs were the main reason for the use of lamps of greater wattage, but there was a tendency toward all-night lighting on account of shunting operations, and colour-light signalling provided a 100 per cent. load factor. Floodlighting for advertising purposes could frequently be arranged to avoid the peak-load period. Domestic lighting could be increased by more use of built-in fittings and the provision of more plugs in more convenient positions. There should be more facilities for the use of table lamps and similar occasional lighting. Potentialities were enormous, if proper tariffs were offered and contractors provided more outlets.

Encouraging "Extravagance"

Mr. Forbes Jackson said that they were beginning a phase of greater, some might say extravagant, use of light. What sort of a price were they going to charge for it? At present the charge was based on what light would fetch rather than on what it cost. In the case of an underground pumping station, two rates were quoted, one for power and the other for lighting. Both circuits, being underground, had the same load factor of 56 per cent., yet the lighting was charged for at 4d. per kWh until he protested, when it was reduced to 2.5d. If they succeeded in selling more light in houses they might have to increase the fixed portion of the two-part tariff, and that would not be desirable.

The use of expensive fittings in schools could not always be justified because of their short-hour use, except when evening classes were held in the same building. His objection to automatic control by means of photo-electric cells was that the switching on and off operation tended to become too frequent. Quite apart from tariffs, the cost of intake service cables for schools was a very important item. In this respect some contribution was needed from the supply authorities.

Mr. J. S. Patmore pointed out that the supply authority had much more to gain than those who furnished fittings and materials. Tariffs based on the kW installed had a psychological effect, which prevented consumers changing over to the two-part tariff, even when the latter could be proved to result in smaller bills. The results obtained by authorities which apparently "gave away" lamps (and even cookers) showed what could be done if the right scheme were adopted.

Dr. Adolf said that they should never forget that the electrical industry commenced with the provision of electric light. They would always come back to their original love. In Berlin there were two rates, based on the number of rooms plus a running charge of 20 Pf. When cooking was introduced a higher basic rate was charged, but the running charge was reduced to 8 Pf. This enabled a more liberal use to be made of illumination. Each time he visited London he

had been more and more impressed with the progress made.

Mr. W. M. Selvey said he had not intended to speak, but the high opinion he had of the author's work induced him to support all he had said. The provision of high standards of illumination in business premises did influence the improvement of domestic lighting, but there was much leeway to be made up. It was not always realised how " bad " were the fittings that some consumers used. In a particular school, for instance, where complaints had been made about the children's sight it was discovered that the illumination nowhere exceeded 1 ft.-candle. Merely by changing the fittings and rearranging them a uniform value of 4 ft.-candles was obtained all over the working plant without increasing the wattage.

Dr. C. C. Paterson pointed out that what was considered adequate to-day might easily be quite insufficient in ten years' time. They must, therefore, be very careful about setting up any standards of performance, since minimum values tended to be accepted as sufficient. Better street lighting did improve levels of interior illumination, since people objected to going from bright streets into gloomy interiors. He would continue to plead for more effective street lighting because it did generally lift up the level of the whole neighbourhood.

Mr. W. J. Jones, replying, said he agreed entirely with Mr. Townley's reservations about small consumers, but they were well worth obtaining when considered per mile of main. Demonstrations were the key to success, but why stop at the showroom? Battens and fittings temporarily installed in shops very frequently induced shopkeepers to improve their methods. Supply authorities did not make sufficient contact with their consumers. The eye was very adaptable. It could, therefore, put up with what it was given, but it could see very much more easily if better lighting were provided.

Water Turbines

THE history of water wheels was reviewed in a lecture recently delivered by Mr. W. A. Kennelly at the JUNIOR INSTITUTION OF ENGINEERS in London. Of the many types suggested only the Francis reaction and Pelton impulse machines have survived. The former can operate with a wide range of heads, as low as one ft. and up to 1,000 ft. This type is sub-divided into several classes, such as open flume for low heads, cylindrical casing for medium heads and spiral casing for both medium and high heads.

The improvement during the last twenty years of propeller and Kaplan turbines has revolutionised the development of low heads, since they have made it possible to obtain much higher running speeds and still use only one runner. They are usually of the vertical shaft type, and the propeller turbine is economical in water consumption only when operated at full load or thereabouts. The blades of the Kaplan runner are movable through the action of a governor to accommodate a wide range of loads and variable head.

Cavitation may be caused in Francis type turbine blades if the specific speed of a given plant be too high for the head, or if the suction head is greater than that permissible. Both the inlet and outlet edges of the vanes may be attacked and both cavitation and erosion caused by abrasive action may occur together; corrosion by acids in the water may also be a danger. Bronze has given good results, but of all commercial metals stainless steel having a high chromium content has proved the most resistant.

The Pelton impulse turbine uses the kinetic energy of a jet of water issuing from a controllable nozzle at high speed and directed on to suitably shaped cups spaced equidistantly and as closely as possible round the rim of a wheel. The exact shape of these cups is highly important, as is also the finish of their interior surfaces, and the casing of the turbine must be so designed as to allow the water to drop straight away immediately each bucket has passed the jet.

The nozzle is fitted with a concentric spear, or needle head, which is movable under the governor action. It is important that the jet should reach the bucket in a solid unbroken and unspreading stream at all loads. Stainless steel is now used for these components in preference to bronze. The speaker devoted much attention to speed control and governing.

Arrangement of Overhead Conductors

By L. F. Villiers

THE main advantages of keeping conductors close together are that it permits the use of smaller cross-arms and shorter poles. With vertical spacing, provided that conductors are equally loaded, there is no danger of wires swinging together. With unequal loading, however, there is a possibility of wires touching. Examples of unequal loading are the conditions due to ice formation and to a number of birds perching. Unequal loading towards one end of a span alters the true sag to a considerable extent, and may raise the unloaded portion of a lower conductor sufficiently to make contact with an upper conductor. An arrangement whereby conductors are staggered is preferable to one in which they are vertically over one another.

The general rule for vertical spacing is 1 ft. per 100 ft. of span, with 1 ft. as a minimum. Although this is considered good practice and on the safe side, it must be admitted that there are a number of lines in this country and abroad with spacings less than this which are giving good service.

When spacing is horizontal the main consideration is the possibility of conductors blowing together under maximum wind-load conditions. Small conductors are displaced in a horizontal direction to a relatively greater extent than large conductors, owing to their greater ratio of wind loading to weight.

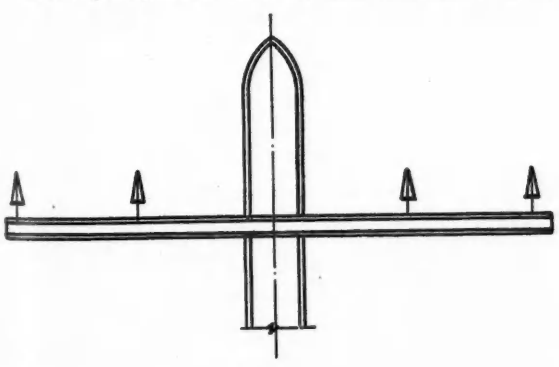


Fig. 1

When erected, the sag of a conductor assumes the form of a parabola. The relationship between the sag and the number of half-swings per minute is as follows: $D = 14{,}600/N^2$ where D = the sag in feet. From this $N = \sqrt{14{,}600}/D$. This gives a method of checking the sags of conductors during erection.

If a number of conductors on a span are erected with the same sag, they should swing equally and could be close together without touching. Under working conditions, however, this is not so. Wind speeds vary at different heights, and a gusty wind makes the movements very erratic. Theoretically, to make it impossible for conductors to touch, they should be spaced at twice the maximum horizontal displacement due to the severest wind loading. The worst possible condition would be a movement through 180 deg. This condition, however, can hardly arise in practice. To give a fair margin of safety, conductors should be spaced at from one to one and a half times the sag.

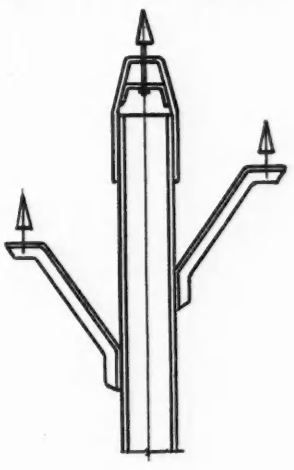


Fig. 2

The wind loading stipulated by the Electricity Commissioners is 8 lb. per sq. ft. on projected areas. The wind loadings specified by authorities abroad vary considerably, but are usually considerably higher; 25 lb. per sq. ft. is commonly used. For round surfaces, however, 0.7 of the projected area only is used.

A horizontal arrangement of conductors, as shown in fig. 1, enables shorter poles to be used, but the ideal arrangement is as shown in fig. 2, where all conductors are offset with each other.

For low-voltage distribution, however, where service connections have to be taken off at the poles, a vertical arrangement is preferable.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Applying for an Appointment

I have read with interest the article and correspondence on this subject, but have failed to learn anything helpful from them. My applications conform to all the requirements of employers. In my opinion they are made out better than is recommended by employers in your paper; but still I fail to get even an interview.

I am an engineer in a small hospital, and I aspire to a responsible post in a large institution, but the wretched forms of application that one has to fill in are a stumbling block. Accompanied, as they often are, by an injunction not to affix any other documents apart from copies of three recent testimonials, they make it impossible to include all the particulars one would like to. The designers of these forms seem to attach too much importance to diplomas, degrees and secondary education. An engineer may hold a dozen diplomas and yet lack practical experience and knowledge, tact, initiative, and self-confidence.

Far be it from me to despise these documentary qualifications, but it isn't everybody who can afford to obtain them. Take the case of a man who wishes to sit for an examination and who is a long way from the nearest evening classes. He has either to pay his fares to and from these classes together with the entrance fee and buy books, or take up a correspondence course which would cost at least half a crown or three shillings a week. Another alternative is to educate himself with the aid of books. All methods cost money, and I am sure there are thousands of intelligent men who simply cannot afford it.

Finally, here is a question which has been asked before in your paper but never answered: What do employers mean when they ask for copies of three "recent" testimonials?

March 13th. UNLUCKY.

I am in full agreement with the points set forth by "Ambitious" in his letter in your issue of March 11th. My present position is that of station superintendent with 25 years' service (A.M.I.Mech.E., A.M.I.E.E.), and I have reached my present dizzy height *via* the ladder of sub-station and switchboard attendant, junior shift engineer, shift engineer and assistant station superintendent. Now I am stuck because employers stipulate such rigid conditions as experience with "Y's" turbines at "X" pressure, and so forth.

During my career many employers have had to take the risk of engaging me in spite of the fact that I have not had experience of the particular type of plant which they have installed. This should be quite an obvious point to all the dozens of prospective employers to whom I have sent applications during the last six years or so.

It appears to me that to sum it all up it amounts to "once a station man, always a station man." Mains people seem to drop into deputy chiefs' and chiefs' jobs, but rarely does one read of a station man being so promoted.

There may be good reasons for this and perhaps someone on the employers' side would cast some light on the position. But it does seem that in these days that a knowledge of cookers and kettles carries far more weight than sound engineering knowledge and experience. THWARTED.

March 12th.

I.E.E. Membership Regulations

Is it not time that the Council of the Institution of Electrical Engineers should consider some amendments to the existing by-laws which would give graduates a fairer deal? Many of us have sacrificed much time and effort to pass the examination, only to find later that the road to corporate membership is beset by unreasonable restrictions and—it is feared—social distinctions.

The present position is this: a graduate cannot obtain his transfer until he has attained a sufficient degree of responsibility as an electrical engineer, and he can seldom hope to be given that responsibility without corporate membership or its equivalent. Suppose this illogical position applied to other professions. A medical or a law student would be unable to practise until he had obtained the requisite experience, and would thus be debarred from acquiring that experience to any useful extent. Fortunately, members of these learned professions are permitted to apply their technical knowledge immediately they have satisfied examiners that they possess it. Can it be seriously maintained that the calling of an electrical engineer requires more stringent regulations than those which apply to professions having statutory recognition?

Moreover, the restrictions do not end here. Not only has the degree of responsibility to be sufficient, but the initiate must be known personally to no less than five corporate members, two of whom must be M.I.E.E.s, and members are asked not to propose anyone without "personal knowledge." A graduate may spend his whole career in a post which never brings him sufficiently into touch with members to enable them to sign his form from personal knowledge. Thus a transfer is made dependent upon circumstances and social standing.

Again, graduates of the Institution pay the full subscription with nothing approaching the outstanding advantages of associate members when applying for a position. In fact, it would seem that graduateship in itself has no weight whatever with employers—even corporate members themselves pay it but scant respect. It is fairly certain, however, that if candidates were provisionally admitted into associate membership after passing the examination, pending acquirement of the necessary degree of responsibility, promotion would speedily follow. Graduates would then find themselves at least in a position to compete with university applicants for technical and administrative positions. At present they do not stand the remotest chance against university degrees.

The trouble is, of course, that employers do not regard graduateship as anything equivalent technically to the A.M.I.E.E., whereas the examination is common to both. It is unlikely that the Council will pay any heed to my small voice, but I would like to put forward the suggestion here that, where a fair degree of experience has been obtained, successful examination candidates should automatically become associate members for a limited period, and if they have not reached the required standard of responsibility at the end of that time their final grading should be decided upon. The question of signatures should be waived altogether, except perhaps as a mere formality. Even so, the requirements would be more severe than in other professions, but they would give a candidate an opportunity as well as some tangible result from passing the examination. A GRADUATE.

March 12th.

Electrical Design at the B.I.F.

A survey of the exhibits at the British Industries Fair has convinced me that there is an increasing realisation on the part of manufacturers of the importance of design as a sales factor, and also that there is a large number of talented men and women actively engaged in designing or offering their designs as free-lance artists to industry.

The National Register of Industrial Art Designers was established by the Board of Trade in order to help in a general advance in the standard of design and our chief task is to compile a register of competent designers, and assist industry by putting the manufacturer in touch with them.

Some of the designers working for the electrical exhibitors at the Fair are already registered, and we should be very pleased, indeed, to know of any others who helped to produce exhibits or who may not be in possession of information, as to the aim of the Register. Full particulars will be sent to any manufacturer or designer who may be interested.

32, St. James's Street, S.W.1, T. A. FENNEMORE,
March 14th. *Registrar.*

[The governing body of this Register is nominated by the Council for Art and Industry, the Royal Academy of Arts, the Royal Society of Arts, the Federation of British Industries, the Association of British Chambers of Commerce, the Design and Industries Association, the National Society of Art Masters, and the Annual Conference of Scottish Art Schools.—EDS. ELEC. REV.]

Fault Localisation

I was greatly interested in the article in your last issue by Mr. G. W. Stubbings on "Fault Localisation," particularly in the two-stage method which he describes.

It does not appear to be necessary, however, to alter the arrangement of the different parts as shown in his fig. 1. Taking the arrangement shown in fig. 2 it is only necessary to disconnect the battery from "earth" and join it to the third wire indicated by the dotted line. This would appear to be quite sufficient, and I am sure he will agree with me that under the "uncomfortable conditions" to which he refers, no doubt feelingly, the fewer connections that have to be altered on the job the better.

I may say that a self-calculating slide-wire bridge which I designed some eighteen years ago will perform both the tests which he describes with great facility. T. W. CORBIN.

Mitcham, *March 15th.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

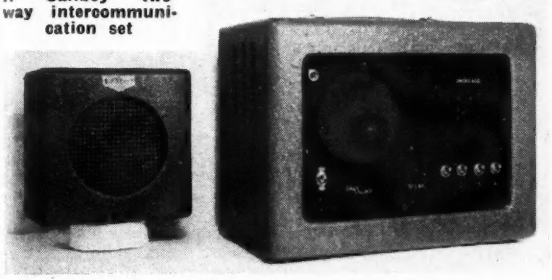
An Intercommunication System

A new sensitive two-way intercommunication system known as the "Callboy" has been introduced by the ELECTRICAL AUTO SERVICES Co., 1, 3 and 18, Brixton Road, London, S.W.9.

The sensitivity is variable and instructions can be given to the staff and replies received without ceasing work as the outfit will pick up speech within eight or ten yards of the special microphone-speakers, up to six of which can be operated from the one master unit, of the desk type. The latter's controls enable any or all of the six speakers to broadcast announcements and accept replies.

As an insurance against fire or burglary the "Callboy" can

A "Callboy" two-way intercommunication set



be installed in such a way that the night watchman can hear any unusual noises, and in hospitals night nurses can listen to the whole ward or to individual patients.

The unit is supplied suitable for a.c. or d.c. at 200/250 V and is easily portable. All control is in the master unit, so that the called person cannot make a call in the ordinary way. The microphone speakers are small enough to be concealed, measuring only 7 in. by 7 in. by 4 in., the dimensions of the master unit being 13¾ in. by 10½in. by 7½in. Thirty feet of twin flexible cable is supplied with each unit of speaker and with every additional speaker.

New "Batwin" Products

Our attention has been drawn by BATWIN ELECTRIC MOTORS, LTD., 138, Southwark Street, London, S.E.1, to several new products.

There is a flexible shaft unit driven by a heavy-duty ¼ h.p. capacitor-start induction-run motor. The shaft is 5 ft. long in bonded rubber with a ⅜ in. core, is easily removed from the motor shaft and is provided with a grease nipple, ball-bearing hand piece, ⅜ in. drill chuck and arbour. The shaft centre height is 1 ft. 9 in. from the floor.

Another newcomer is a blower of unit construction, in various sizes from 75 c.f.m. to 1,200 c.f.m. New methods of manufacture have been employed in the production of multi-blade blower wheels. The blades are die formed in pairs exactly alike in form, thickness and weight. A single piece of 1/32 in. thick soft sheet steel is formed into two blades which have the form of a rectangle with one open end. The two ends are pressed through slots in the back plate, which have the same curvature as the blades. Each blade is fixed at exactly the same angle. The section joining each pair of blades is then spot welded to the back plate. A machine of special design completes the process by bending smoothly the projecting ends against the outer face of the inlet disc.

To obtain added strength these ends are also spot welded

The "Batwin" flexible shaft unit and single-ended blower

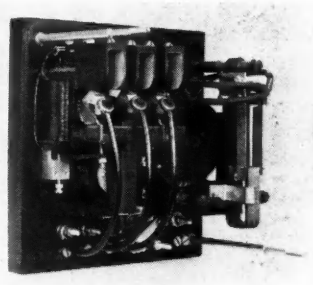
on the larger wheels. Both internal and external hubs are available, those for the smaller size wheel being machined from solid steel stock and having one square head set screw, while the larger hubs are of cast iron and have both set screw and keyway. Four steel braces are used in single inlet wheels of from 9 in. by 6 in. upwards.

There is also a high-speed nozzle type blower weighing only 5 lb. and fitted with a heavy-duty motor which runs at 12,000 r.p.m. The switch is situated on the handle through which the flexible cable passes.

A Load-levelling Device

With a view to improving the domestic load factor A. REYROLLE & Co., LTD., Hebburn-on-Tyne, have introduced an off-peak load-discriminating device. The "Reyvaux" unit consists of a transformer-operated bi-metal relay, which can be set by means of a link to trip at various current values, and a double- or triple-pole contactor, the whole mounted on a moulded base and protected by a sheet-metal cover.

Triple-pole "Reyvaux" unit with cover removed

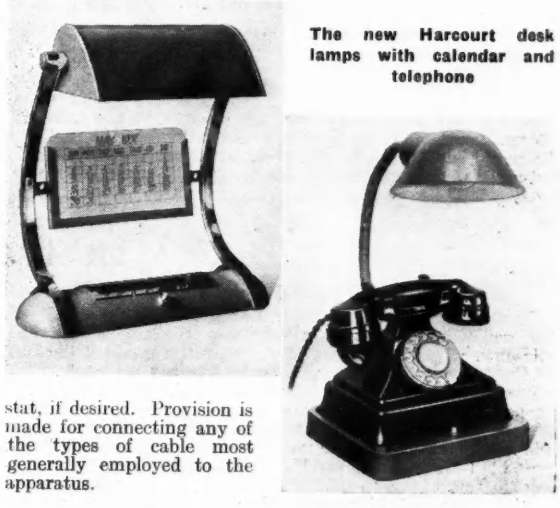


The transformer has its primary winding in series with one side of the normal load and its secondary connected to the bi-metal strips. It is of the saturable-core type and is so designed that the primary can carry up to 25 A, but the secondary current cannot greatly exceed the value required for the operation of the relay contacts.

With the standard type of current transformer when the load falls to about three-quarters of any predetermined value between 3 and 9 A the relay closes and (since its contacts are in series with the contactor operating solenoid) completes the circuit of the auxiliary load (*e.g.*, a water heater). Conversely, when the load exceeds the selected value the relay opens, switching off the auxiliary load.

A latched-in type of contactor is incorporated to secure silent working, the use of a small adaptor enabling a water heater to be controlled by an ordinary single-pole one-way thermo-

The new Harcourt desk lamps with calendar and telephone



stat, if desired. Provision is made for connecting any of the types of cable most generally employed to the apparatus.

Unusual Lighting Fitting Combinations

Two unusual lighting fitting combinations have been introduced by HARCOURTS, LTD., 1, Kean Street, Aldwych, London, W.C.2.

One comprises a heavy cast iron base on which a standard G.P.O. desk telephone stands. At the back of the stand is fitted a flexible arm having a reflector and lampholder suitable for a 25- or 40-W pearl lamp. The flexible arm enables the light to be adjusted to any adjacent position, the main purpose of the fitting being to illuminate the dial of the telephone and facilitate reference to the telephone directory.

The unit is available in standard G.P.O. colours, black, red, green and ivory, or with the base only in these colours, and the flexible arm and reflector in chromium plate. The base is supplied in two sizes, with and without a bell in the base.

There is also a calendar desk standard comprising a heavy base 13 in. long by 4¾ in. high, with two curved arms carrying an adjustable trough reflector. Beneath the reflector is a frame fitted with a monthly calendar of standard size. The overall height is 14 in. and a lamp of up to 60 W can be accommodated. The base is fitted with a press switch and removable tray, the exterior of the reflector and base being finished in black, green or bronze with arms in chromium plate.

E

Parliamentary News (BY OUR SPECIAL REPORTER)

Railway Coach Lighting

In the House of Commons on March 2nd Mr. Day asked the Minister of Transport whether he would give the number of gas-lighted coaches still operating on the British railways' steam-worked coaching stock; and what progress had been made by the railway companies during the last three years with the conversion to electric lighting.

Mr. Burgin said that the numbers of passenger -carrying coaching vehicles (other than electrically operated) owned by the railway companies at December 31st, 1935, 1936 and 1937, which were lighted by gas and electricity respectively were as follows:—

	Lighted by gas.	Electrically lighted.
1935	9,713	30,510
1936	7,437	32,411
1937 (provisional figures)	6,295	34,586

Supplies in East Anglia

On March 2nd Colonel Heneage asked the Minister of Transport if he would give the number of parishes supplied by electricity undertakings in the Caister, Louth and Grimsby Rural District Council areas for 1935, 1936 and 1937, respectively, and those which were not provided with an electricity supply.

Mr. Burgin said that the following was the information:—

Rural District.	No. of parishes.	No. of parishes in which mains were laid at:—			
		31.3.35	31.3.36	31.3.37	1.3.38
Caister	39	2	5	8	11
Grimsby	21	12	13	13	13
Louth	79	3	9	16	25
	139	17	27	37	49

Of the ninety parishes in which no mains had been laid seventy-seven had a population of less than 250.

The Trade Marks Bill

The report upon this Bill (which was dealt with in our issue of February 4th, p. 154) by a Joint Committee of both Houses of Parliament was published last week. The Committee says that, having carefully considered the Bill and heard evidence upon it, it is of opinion that the Bill, as drafted, is pure consolidation and represents the existing law, and it directs that the Bill shall be reported without amendment. In an appendix the Committee draws attention to several points which require explanation.

Television and Broadcasting

On March 9th Major Tryon, the Postmaster-General, in moving a supplementary estimate of £360,000 for the British Broadcasting Corporation, said that of that sum £50,000 represented three-quarters of extra net licence revenue received. It was expected that by the end of this month 8,540,000 licences would have been issued, whereas it was originally estimated that only 8,400,000 listeners would take out licences. There were two entirely new features. First, there was the expansion of television, which accounted for an additional £295,000, and also about £15,000 proposed for broadcasting news in foreign languages.

It was intended that 8 per cent. of the net licence revenue, in future, should go to the B.B.C. for television work. It was obvious that there must be greater accommodation of studios, &c., at Alexandra Palace if there was to be an efficient service. The television service would soon—he believed next month—be extended to Sundays from 9.5 p.m. until 10.5 p.m., and an additional half-hour was going to be given in the evening programme. When the studio accommodation had been improved it would be possible to add to the length of programme time. The technical standards of television had been stabilised for three years, giving security to producers of sets and encouraging them to make more and cheaper sets.

For the foreign language broadcasts the B.B.C. had to use the existing Empire transmitters, but two additional high-power transmitters had been ordered which it was hoped would be in use early next year.

The vote was agreed to.

Railway Electrification

On March 9th Mr. Day asked the Minister of Transport whether, in view of the fact that there were over 1,800,000 unemployed, he would state what steps were being taken to expedite the speeding up of work necessary for the transmission and development of the ordinary electrical programmes and the electrification of railway lines, with a view to reducing the unemployment figures.

Mr. Burgin said he was satisfied that the electrical industry continued to expand progressively and that the railway companies were proceeding expeditiously with the various schemes of electrification which they had in hand. He had no power to require works of electrical development to be undertaken.

Public Utilities in War Time

On March 14th Sir J. Mellor asked the Home Secretary whether he would identify the undertakings that he had consulted with regard to the most effective way of assisting electricity, gas, and railway undertakings, respectively, to continue functioning in war time; and whether he would state how long consultations had been in progress in each case.

Mr. G. Lloyd said that the measures to be adopted would differ according to the type of utility. On electricity, the Electricity Commission had consulted a number of large undertakings in important industrial areas. Consultation with the railways had proceeded through a technical committee appointed by the railway managements. In the case of gas, consultation had taken place with representatives of three of the largest producers. In the case of water and docks, discussions had been held with the engineers of the Metropolitan Water Board, the Mersey Docks and Harbour Board, and the Port of London Authority respectively. As a result of the help afforded to the Department by these conversations, the Home Secretary intended shortly to consult the representative bodies of each of the public utilities.

In the Courts

Contraventions of the Factory Act

In Glasgow Sheriff Court on March 10th a fine of £7 was imposed on a firm of terrazzo workers, Toffolo, Jackson & Co., Glasgow, who were found guilty of a contravention of the Factories Act. The firm was also ordered to pay 30s. costs. The prosecution was conducted by Mr. F. W. Thompson, H.M. Inspector of Factories. The charge was that on December 21st, 1937, they failed to comply with regulations under the Act in respect that the metal-work of an electrically driven portable floor polishing machine, while standing on a conducting surface, was not sufficiently earthed, whereby an employé of the firm was liable to get a shock if the metal-work of the apparatus became charged. The employé, who was also summoned, pleaded guilty and was admonished.

At Lanark Sheriff Court last week Sheriff Wilton, K.C., imposed a fine of £10 on Jack's Knitwear, Ltd., Cleghorn, on a charge brought at the instance of H.M. Inspector of Factories. It was alleged that the company, being occupiers of an electrical station, neglected to observe requirements of the Factory and Workshops Act, 1901, in that they failed to have securely fenced a shaft connecting a water turbine and a driving pulley and that in consequence of their neglect an employé suffered bodily injury and died. The managing director of the company spoke of visits of H.M. Inspectors and instructions given by them for the proper fencing of machinery. He stated that he gave instructions to the deceased, who was in charge of the machinery of the factory, to carry out the necessary fencing. This was reported to him as having been done. An agent maintained for the respondents that they had not been negligent and had used due diligence in seeing that the fencing was carried out. The Sheriff thought the attitude of the company was perfectly proper, and it came very near to using due diligence but failed by a little to do so.

Winding-up Petitions

In the Companies' Court on March 14th Mr. Justice Bennett had before him a petition by Greaves & Thomas, Ltd., cabinet makers, Northwold Road, London, E., for the compulsory winding-up of Warner's Radio & Electric, Ltd.

Mr. Lindon said he appeared for opposing creditors for £54,000. A meeting of creditors and shareholders of the company was called for March 16th to consider the matter. The company was not in voluntary liquidation but he (Counsel) understood that there was a general desire for a voluntary liquidation. In the result his Lordship ordered the petition to stand over until March 21st.

On the same day Mr. Justice Bennett heard a petition for the compulsory winding-up of Edison Bell (1933), Ltd.

Mr. Buckley, in support of the petition, said it was by judgment creditors of the company for £1,693 and costs and one creditor had given notice of support. There was no opposition. The company did not appear and his Lordship made the usual compulsory order.

Magnetic Testing

Since the publication in 1936 of the fourth edition of Circular C.17, magnetic testing, of the National Bureau of Standards (United States Department of Commerce), new magnetic materials and testing apparatus have been developed. In the new edition, C.415, the pamphlet has been revised and enlarged to thirty-four pages, with sixteen figures, and includes, in addition to information on magnetic quantities, units and testing methods, a brief discussion of magnetic analysis by which the mechanical quality of materials may be judged from their magnetic characteristics.

British Overseas Electrical Trade

Allowing for the shorter month exports were well maintained during February

CONTINUING the trend of recent months, British electrical exports in February were 29 per cent. above the value for the corresponding month of last year and imports were down by 17 per cent. The accompanying Table I, compiled from figures published in the February Board of Trade returns, shows that exports attained the value of £1,719,661, an increase of £380,383, and it is interesting to note that this total is again higher than for any like month since at least 1924.

The drop, compared with the £1,863,552 in January, was to be expected on account of the shorter month. Actually, the average per working day was approximately £66,000 in each case. One purpose which the difference in the months serves is to bring out the types of exports which improved exceptionally. Shipments of machinery, for instance, rose in value from £603,943 to £618,459 on the month, and among goods and apparatus radio transmitters, primary batteries, shipments of insulated types other than telegraphic and telephonic was practically the same as in January. An analysis reveals that the expansion last month was principally in exports of wires and cables with insulation other than rubber, which accounted for £86,721. The chief destinations, with values for last month, and February, 1937, in parentheses, were as follows:—

Rubber-insulated wires and cables.—Australia, £32,431 (£32,899); British India, £18,241 (£17,495); South Africa, £13,788 (£23,058); New Zealand, £8,563 (£7,706); other British countries, £24,453 (£13,770); and foreign countries, £18,673 (£8,462). Total, £116,149 (£103,390).

Electric wires and cables, insulation other than rubber.—South Africa, £52,966 (£48,991); British India, £45,627 (£11,644); Australia, £37,357 (£19,894); other British countries, £43,314 (£19,219); and foreign countries, £15,750 (£8,545). Total, £195,014 (£108,293).

Radio equipment manufacturers continued to achieve greater success in overseas markets, with increases under each heading. Receivers sent abroad numbered 5,624 (against 4,812) and valves 142,503 (131,449). In telegraph and telephone equipment other than radio the total of £180,501 was allocated according to countries as follows, with comparative values for February, 1937, in parentheses:—Australia, £57,604 (£44,173); Argentina, £16,808 (£12,468); South Africa, £13,937 (£6,473); other British countries, £49,083 (£21,595); and other foreign countries, £43,069 (£46,771).

Machinery exports were heavier in each classification, although shipments of generators show a small drop in value. The following figures relate to the weight in tons in each class last month and in February, 1937:—Generators up to 200 kW, 156 (143); generators over 200 kW, 648 (542); motors, 1,029 (852); convertors and transformers, 974 (745); starting and controlling gear for motors, 178 (140); and switchgear, 755 (670).

Imports again diminished in most classifications, but chiefly in radio equipment, and last month machinery imports other than motors also fell off. The United States was the greatest loser, as is shown in the following analysis of imports of goods and apparatus:—Germany, £57,116 (£67,450); United States, £55,919 (£88,383); Netherlands, £48,372 (£69,087); Belgium, £30,590 (£25,463); Switzerland, £12,088 (£16,405); France, £11,730 (£4,332); Austria, £3,744 (£5,334); other foreign countries, £21,766 (£27,709); and British countries, £6,704 (£9,492). Total, £248,029 (£313,655).

Radio receiving sets other than radiogramophones brought into this country numbered only 1,457, as compared with 5,769 in February, 1937, and the number of valves imported was 101,727, against 244,225. It is also worthy of note that although imports of vacuum cleaners declined slightly in value the weight rose by 50 per cent.—from 24 to 36 tons. Imports of electrical machinery as a whole increased from 213 to 260 tons.

electric cooking and heating apparatus, house service meters, other electrical instruments, and insulating materials not elsewhere specified were notable for a like reason. Exports of cooking and heating apparatus, in particular, have shown a very satisfactory expansion recently, and the February value was 48 per cent. more than a year ago.

In the wires and cables group the increase of £99,480 in

TABLE I.—EXPORTS AND IMPORTS DURING FEBRUARY.

	Exports. Feb. 1938.	Exports. Inc. or dec. compared with Feb., 1937.	Imports. Feb. 1938.	Imports. Inc. or dec. compared with Feb., 1937.
Submarine telegraph and telephone cables	£15,469	+ £15,101	*	—
Telegraph and telephone wires and cables (not submarine)	82,119	+ 27,829	*	—
Other insulated wires and cables	311,163	+ 99,480	£45,849	+ £1,788
Radio receivers, not radiograms (excluding valves)	32,507	+ 1,888	6,089	— 7,082
Radio transmitters (excluding valves)	39,187	+ 31,900	*	—
Radio valves	38,344	+ 6,510	9,469	— 9,824
Other radio parts and accessories	35,720	+ 10,220	44,628	— 28,659
Telegraph and telephone apparatus (other than radio)	180,501	+ 49,021	*	—
Electric carbons	*	—	5,121	+ 455
Incandescent lamps	50,802	+ 2,850	11,274	— 8,631
Other lighting apparatus	43,620	— 6,599	40,905	+ 2,003
Primary batteries	10,655	— 2,512	*	—
Accumulators	52,679	+ 8,789	*	—
Electric cooking and heating apparatus	33,924	+ 10,996	*	—
House service meters	17,292	+ 5,689	*	—
Other electrical instruments	26,433	+ 10,548	26,618	— 5,661
Insulating materials, not elsewhere specified	14,069	+ 664	*	—
Unenumerated electrical goods and apparatus	116,708	+ 24,906	58,076	— 10,015
Electric generators up to 200 kW	32,313	— 121	*	—
Electric generators over 200 kW	95,812	— 219	*	—
Electric motors	141,779	+ 18,925	28,095†	+ 5,161
Convertors and transformers	113,460	+ 33,671	*	—
Starting and controlling gear for motors	41,162	— 2,185	*	—
Switchgear	151,596	+ 31,453	*	—
Other electrical machinery	15,505	+ 2,871	16,080	— 4,759
Electric vacuum cleaners	26,832	— 1,292	11,783	— 582
Total	£1,719,661	+ £380,383	£303,987	— £65,806

* Not classified separately. † Not railway and tramway motors.

TABLE II.—BRITISH ELECTRICAL EXPORTS DURING FEBRUARY

Destination.	Goods and apparatus, Feb., 1938.	Inc. or dec. compared with Feb., 1937.	Electric generators, Feb., 1938.	Inc. or dec. compared with Feb., 1937.	Electric motors, Feb., 1938.	Inc. or dec. compared with Feb., 1937.	Other electrical machinery, Feb., 1938.	Inc. or dec. compared with Feb., 1937.
Eire	£37,054	+ £11,318	*	—	*	—	*	—
Channel Islands	7,707	— 6,637	*	—	*	—	*	—
Palestine	9,797	+ 879	*	—	*	—	*	—
British West Africa	11,926	+ 1,715	*	—	*	—	*	—
Union of South Africa	138,539	— 4,258	£45,831	+ £22,578	£37,007	+ £2,332	£82,059	— £24,649
British India	164,807	+ 67,819	4,137	— 13,238	31,797	+ 17,309	52,381	+ 10,460
British Malaya	41,923	+ 13,603	*	—	*	—	26,645	+ 19,973
Ceylon	8,768	+ 3,178	*	—	*	—	*	—
Hong Kong	12,614	+ 6,706	*	—	*	—	*	—
Australia	186,512	+ 45,912	33,724	+ 21,629	12,905	+ 2,258	27,356	— 7,934
New Zealand	118,107	+ 59,712	*	—	2,961	— 1,411	12,660	— 2,138
Canada	9,199	+ 2,018	1,449	— 1,284	7,547	+ 4,726	22,444	+ 20,538
Other British Countries	45,502	+ 13,480	28,505	— 16,238	21,675	+ 4,617	48,604	+ 29,992
Sweden	10,337	+ 1,702	*	—	*	—	*	—
Denmark	12,276	+ 891	*	—	*	—	*	—
Netherlands	17,247	+ 6,037	*	—	*	—	5,203	+ 4,226
Belgium	10,747	+ 813	*	—	*	—	*	—
France	16,484	+ 3,980	*	—	*	—	3,146	+ 110
Portugal	7,583	— 9,516	*	—	*	—	*	—
Spain	2,744	— 21	*	—	*	—	*	—
Italy	6,121	+ 4,237	*	—	*	—	*	—
Greece	4,332	+ 171	*	—	*	—	*	—
Rumania	5,209	+ 4,825	*	—	*	—	*	—
Egypt	11,802	+ 4,216	*	—	*	—	482	+ 114
China	4,019	— 9,658	*	—	*	—	3,430	— 690
Brazil	24,964	+ 11,080	*	—	*	—	*	—
Argentina	43,440	+ 5,290	*	—	*	—	1,577	+ 313
Other Foreign Countries	131,442	+ 57,788	14,479	— 13,787	27,887	— 10,906	35,733	+ 15,495
Total	£1,101,202	+ £297,280	£128,125	— £340	£141,779	+ £18,925	£321,723	+ £65,810

* Not classified separately. Vacuum cleaners are included in Table I but not in Table II.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Hire Purchase Bill

Speaking at the annual dinner of the Hire Purchase Traders' Association on March 8th Sir Harold Bellman (president) said that they regarded the Bill submitted to the House of Commons by their guest of honour, Miss Ellen Wilkinson, as a sincere attempt to curtail the activities of those traders, happily a small minority, whose harsh and inequitable procedure had justly aroused much public indignation and adverse criticism. Unfortunately, however, the Bill had undergone drastic revision in the Committee stage. In curbing the undesirable practices of a minority of traders, grave injustice would be done to the majority of reputable trading concerns unless further amendment was made on the report stage. The amendments suggested that while Parliament recognised there were some bad hire purchase traders, it failed to appreciate there were also bad hirers in respect of which the trade was entitled to some protection. It was proposed that once one-third of the hire purchase price had been paid, even if the owner or trader caught an unscrupulous hirer in the act of removing the goods, he was powerless to intervene. Originally, the provisions were to apply to an article not exceeding £50 in value. This figure was reached by mutual agreement, the House of Commons Committee had however, to the consternation of the trade, increased this limit to £100.

A Lamp Sales Conference

A conference of factors engaged in the sale of "Atlas" lamps was held at the Waldorf Hotel, London, on March 9th. The proceedings were opened by Mr. J. Thorn, chairman and managing director of the company, and other directors and the sales manager were present. It was explained to the meeting that, before deciding the details of the sales policy for the coming season, the company felt that the factors should express their views in order that all decisions might be made jointly. A discussion ensued and the details of the policy were laid down by the decisions arrived at. In discussing publicity, the company stated that a considerably larger expenditure would be made this year and the main channels for this expenditure were agreed by the conference. During the afternoon session some time was devoted to the discussion of social activities, and it was suggested that a golf competition might be organised. The conference was followed by a dinner at the hotel and attendance at the evening performance of "Hide and Seek" at the London Hippodrome.

Municipal Electrical Trading at Finchley

With regard to the sale of fittings and appliances at the electricity showrooms, the Finchley Borough Council recently approved a recommendation of the Electricity Committee that a previous resolution deferring sales for two years should be rescinded, and that the sale of a full range of electrical fittings and equipment should be undertaken. It was proposed that discounts and commission on orders should be paid to contractors, and that all equipment with a minimum value of £2 should be offered on hire-purchase terms. Councillor Caine, chairman of the Committee, said that since the undertaking's domestic development programme was started £4,000 had been paid to local wiring contractors for work done.

Manchester Brighter Homes Exhibition

In the Manchester Brighter Homes Exhibition which is being held in the City Hall, Deansgate, until March 26th, there is on view a comprehensive range of domestic electrical apparatus. Electric washing machines are given considerable prominence, also vacuum cleaners. Among the principal exhibitors are: Beatty Bros., Ltd.; British Vacuum Cleaner & Engineering Co., Ltd.; Bulle Products, Ltd.; W. T. Driver; Electrolux, Ltd.; Grayson Supply Co., Ltd.; W. & V. Moore, Ltd.; Hoover, Ltd.; and Underwood (Electric), Ltd.

A Long-service Cable

The partly calcined object shown in the accompanying picture is a forty-year old piece of Henley cable recently taken from the Llandudno Corporation system after a breakdown. A technical report on the piece of cable which had not suffered damage showed that there were no signs of deterioration in the paper insulation, which was still well impregnated, and the impregnating compound was in good condition. The burn-out completely destroyed any evidence there may have been as to the cause of the breakdown. However, as the cable had been in use for forty years and the remainder of the length is still in service, as good as new, it would appear that the breakdown must have been caused by some agency other than the cable itself.

A piece of Henley cable after forty years' service

Norwich and District Circle

Recently the Norwich and District Electrical Development Circle heard the first of a series of lectures on "Modern Wiring Practice," which was delivered by Mr. F. C. Raphael at the Stuart Hall. More than 100 members' friends also attended, and were welcomed by Mr. R. W. Steel, the chairman. The lecturer dealt with the various systems of electrical wiring and answered many questions.

A Lamp Window Display

The accompanying illustration shows an interesting "Mazda" lamp display recently installed in the B.T.H. Co.'s showroom window at Crown House, Aldwych, W.C. The twelve sizes of general lighting service lamps from 15 W to 1,000 W are contained in the main display cabinet. They are connected to a flasher, and as each lamp lights, the panel above, giving the hours of light per kWh, is also illuminated. In the foreground are displayed the various types of lamps for each wattage group.

A "Mazda" lamp display at Crown House, Aldwych

Works Recreation Hall Lighting

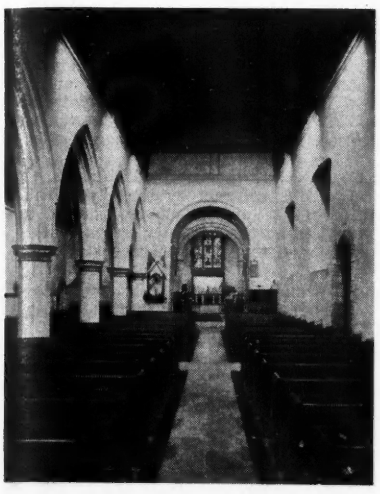
In planning the lighting of the new recreation hall and gymnasium recently built for the employés of W. D. & H. O. Wills, Ltd., it was desired that pendants should be avoided if possible, especially in the gymnasium where clear space is required for apparatus. The architects arranged for the main daylight illumination to be provided from large laylights in the ceiling and advantage was taken of these to provide the artificial lighting also. In the recreation hall the laylight occupies a space of 44 ft. by 15 ft. Despite the fact that this is glazed with a very lightly diffused glass only, G.V.D. Illuminators provide an even flood of light over the surface of the laylight itself and throughout the room from eight lamps only. A similar method is used to light the gymnasium, six lamps being used to light this 33 ft. by 15 ft. laylight. To supplement the lighting on the walls a continuous panel about 1 ft. wide runs along each side of the gymnasium. Lamps in these panels are spaced every three feet.

A Management Conference

The thirty-eighth Oxford Management Conference organised by the Confederation of Management Associations will be held at St. Hilda's College from March 31st to April 4th. The topic this time is "Optimum Productivity in Modern Industry," being a survey of the conditions of the best possible output, having regard both to technological and human considerations. Various eminent persons in industry will preside at the different plenary sessions, including Sir Felix Pole, chairman of Associated Electrical Industries, Ltd.

A Church Lighting Installation

The accompanying illustration shows the interior of Shipley Parish Church, Sussex, in which a Holophane lighting scheme has recently been installed. The lighting is by means of the new Holophane multi-flood "junior" troughs, fixed behind the beams, and projected forward and downward.



A Holophane lighting installation in Shipley Parish Church, Sussex

The lighting effect is particularly striking, because special straw-colour pin-head glass fronts are fitted to the multi-flood junior troughs in the chancel, nave and aisles. The chancel window has been floodlighted from outside by means of concentrating floodlights, which serve to reveal the beauty of the stained-glass designs.

New E.C.A. Members

At a recent meeting of the Council of the Electrical Contractors' Association the following contractors were admitted to full membership:—

S. B. Hopkins & Co., Ltd., 259, Holloway Road, N.7; Morris Bros., Camberley; B. W. Brighty, Abridge; H. & E. Engineers, Ltd., Oxford; W. S. Barron & Son, Ltd., Gloucester; Amies & Sons, Ltd., Peterborough; Carver & Lee, Keighley; A. Imeson, Haworth; S. D. McKee, Keighley; J. S. Ramsbottom & Co., Ltd., Keighley; J. Whitham, Silsden; H. Wilkinson, Keighley; J. N. Whiteside, Blackpool; Aldreds, Ltd., Driffield; the Central Electrical Engineering Co., Hull; Massey, Pepper & Co., York; Turner Bros (Hull), Ltd., Hull; A. E. Cheshire, Vicars Cross, Ches.; Milton's Battery Service, Chester; H. Morgan, Chester; Fillingham & Thompson, Urmston; E. Lee & Co., Manchester, 15; Meta, Ltd., Manchester; A. S. Hobson, Newcastle-on-Tyne; T. Dryden & Sons, Ltd., Preston; W. Greenwood, Bamber Bridge, near Preston; H. W. Naylor, Broughton, Preston; H. Greenwood & Son, Milnsbridge, Huddersfield; and J. Sutton, Leigh.

The following contractors were admitted to associate membership:—

D. J. Spire & Co. (1935), Bourne; F. Fradley, Ltd., Hanley; W. A. Jordan, Stafford; S. S. Haworth, Blackburn; J. H. Carter, Digbeth, Birmingham.

A Scottish Asbestos Cement Factory

Plans for a new £40,000 factory to be built by Turners Asbestos Cement Co. at Dalmuir were approved by the Clydebank Dean of Guild Court on February 21st. The site is the former shipyard of William Beardmore & Co., on the north bank of the Clyde, which was dismantled in 1931. Demolition work is now in progress, and the twenty-acre site is being rapidly cleared for the erection of the new factory. When reconditioned, the building will consist of five bays, 50 ft. wide and over 1,000 ft. in length. The construction and equipment of the works, with new plant for the manufacture of asbestos cement pressure pipes and roofing materials, will cost £200,000, and it is anticipated that production will commence about June 1st this year.

Cable and Wireless West Indies Services

The business of Cable & Wireless, Ltd., in the West Indies, previously conducted by several companies, is being consolidated in the hands of the wholly owned subsidiary, the West India & Panama Telegraph Co., Ltd. Cable & Wireless, Ltd., now announces that the name of the West India & Panama Telegraph Co., Ltd., has been changed to Cable & Wireless (West Indies), Ltd.

Belgian Foreign Electrical Trade

The following table shows the Belgian imports and exports of electrical machinery, apparatus and cognate goods during 1937 as compared with those of the preceding year. The values against the separate items are in thousands of Belgian francs, while for purposes of comparison, the total in sterling at 143¼ fr. to the £ has been added. It will be seen that the imports show an advance of £519,642 (nearly 21 per cent.), while exports increased to the extent of £1,180,607, or over 63 per cent.

	Imports.		Exports.	
	1936.	1937.	1936.	1937.
	1,000 fr.	1,000 fr.	1,000 fr.	1,000 fr.
Dynamo-electric machinery	56,287	76,310	22,830	37,010
Dry batteries	4,450	4,715	213	186
Accumulators and parts	1,933	3,180	3,383	4,132
Magnets (other than electro-magnets)	2,238	3,175	12	6
Land and submarine cables	1,117	1,008	39,214	93,013
Insulated wires and cables	14,414	21,853	42,928	58,393
Copper wire and cables (not insulated)	602	854	4,769	24,391
Carbons and electrodes	7,515	10,011	104	191
Porcelain insulators, etc.	1,703	5,267	389	455
Electric globes, bulbs and glassware	8,113	10,560	8,555	7,413
Insulating tubes, junction boxes, etc.	3,878	4,148	1,747	2,696
Other insulating material	3,149	4,013	417	501
Arc lamps	170	162	2	14
Incandescent lamps	19,894	21,887	14,578	18,858
Radio valves	31,375	31,930	1,859	2,532
Electrical measuring instruments	18,481	21,980	1,532	2,537
Telegraph and telephone apparatus	4,839	6,404	79,325	110,477
Wireless transmitting and receiving apparatus	14,896	13,691	7,619	17,833
Wireless sets, not assembled	2 151	2,368	13,692	21,563
Wireless loud speakers and microphones	5,183	5,091	4,951	3,712
Wireless parts	17,008	17,153	1,251	1,108
Other electrical apparatus and goods	135,556	163,752	17,083	28,849
Total fr.	354,952	429,512	266,453	435,870
Total sterling at 143¼ fr. to £	£2,473,533	£2,993,175	£1,856,815	£3,037,422

Aluminium Production in Holland

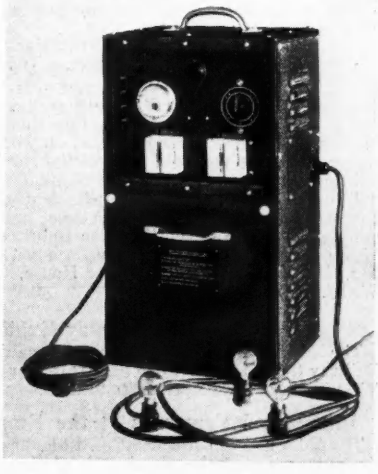
The formation has taken place at Amsterdam of the Nederlandsche Aluminium Maatschappij, with a share capital of 1,000,000 fl., which is to produce aluminium by means of electrolysis. This follows the constitution of the Neder. Aluminium Wals en Persbedrijven for the rolling and pressing of aluminium.

The South London Exhibition

The South London Exhibition is once again now being held at the Crystal Palace. Last year's function was cancelled owing to the fire there, and the present exhibition is being held in temporary canvas pavilions. The exhibition closes on March 26th.

Emergency Lighting

In view of the interest which is now being taken in emergency lighting in air raid conditions a self-contained portable emergency lighting unit which has just been placed on the market by Batteries, Ltd., is of interest. This unit, known as the "Nife-Neverfayle," has a number of interesting features. Immediately the main supply fails emergency lamps are illuminated automatically from a "Nife" nickel-cadmium battery contained in the unit. Emergency lights can be maintained from the mains while they are available and are automatically transferred to the battery immediately the supply fails. Low-voltage emergency lights are used and the mains connection is made to any convenient plug socket as in the case of any domestic appliance. The set is available in five sizes capable of maintaining emergency loads varying from 24 to 96 W for a period of six hours.



The "Nife-Neverfayle" emergency lighting unit

Cyprus Import Duty Reduction

With reference to the note which appeared in our issue of February 25th regarding the reduction of duty on certain electrical goods imported into Cyprus, the reductions mentioned (to 10 per cent. preferential and 18 per cent. general *ad valorem*) do not affect machinery, electric bell apparatus

and parts thereof; electric lighting appliances, accessories, fittings and parts thereof (not being machinery); telegraph and telephone apparatus and parts thereof, including wire and cable; and radio receiving and transmitting apparatus and parts thereof. The reductions apply only to electrical goods other than these.

Lamp Production in Italy

The Italian self-sufficiency campaign is making great progress in the electric lamp branch, reports *Reuters Trade Service* from Milan. Whereas ten years ago Italy produced only 40 per cent. of the total home demand, the rest being covered by imports, this has now been raised to 85 per cent.

An Electrical Male Voice Choir

More than twenty members of Henley's head office staff have formed a male voice choir to sing at Wednesday lunch-time services at St. Sepulchre's, Holborn Viaduct. The members of the choir made their initial concerted effort on Ash Wednesday, but individually they have had previous experience of choral work in other churches.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors the following applications for registration were accepted:—

Edgar C. Porter, Ltd., Ilford; Campbell & Isherwood, Ltd., Bootle, Liverpool, 20; Gallagher & Co. (Electricians), Ltd., Sheffield; Alex. S. Addison & Co., Ltd., Glasgow, S.4; John Hearson & Co., Ltd., 4, Portsmouth Street, Kingsway, W.C.2; S. B. Hopkins & Co., Ltd., 259, Holloway Road, N.7; and the Gooding Electrical Co., 7, Kenton Street, Russell Square, W.C.1.

At the same meeting one application was withdrawn and two were declined.

Non-metallic Bearings

Among the advantages claimed for bearings made of synthetic resinous products compared with metal are a longer life, lower friction losses and absence of oil lubrication. Regarding the first, Ellison Insulations, Ltd., inform us that recently at a steel mill 3,000 tons of steel were rolled with bronze bearings and 104,000 tons with bearings made of "Tufnol." The former were worn out in ten days whereas the latter at the end of six months (when the tests were discontinued) were good for many more tons. Further particulars of this development are given in List No. 171 compiled by the company.

Electricity in the Kitchen

A small exhibition which was opened yesterday at the Building Centre, 158, New Bond Street, London, makes a special feature of the use of electricity in the kitchen. The display will be on view until April 2nd.

For Sale

St. Helens Corporation Electricity Department has d.c. prepayment meters for sale.

Kettering U.D.C. Electricity Department has for disposal a 33-kV outdoor switching station.

(See our classified advertisements.)

Lighting and the New Factory Act

A round-table public discussion on the lighting provisions embodied in the new Factory Act will be held under the auspices of the Industrial Lighting Section of the Illuminating Engineering Society, at the Home Office Industrial Museum, Horseferry Road, S.W.1, on March 29th. Speakers representing the points of view of the employer, the employé, lighting expert and the administration will take part, and will include Dr. S. English, president of the Illuminating Engineering Society. Tickets (free) may be obtained on application to the secretary of the Industrial Lighting Section of the Illuminating Engineering Society (Mr. C. W. M. Phillips, B.T.H. Co., Ltd., Crown House, Aldwych, London, W.C.2.

The Model Railway Exhibition

The Model Railway Exhibition, organised by the Model Railway Club, Ltd., is to be held this year at the Central Hall, Westminster, from April 19th to 23rd.

Illuminated Fountains at the Empire Exhibition

The Edison Swan Electric Co., Ltd., has been appointed by the authorities of the Empire Exhibition, Glasgow, to carry out the complete lighting installations of the lake fountain scheme and the fountain outside the Palace of Engineering. Colour changing illuminations with elaborate water displays are to be a feature of the lake scheme, which will comprise a large two-tier circular fountain and two flare fountains of novel design, flanked on each side by eighteen smaller fountains. In front of the Palace of Engineering a large circular fountain built in three tiers and set in a rectangular pool will also be provided with striking lighting effects to harmonise with the water displays. The various combinations of colour floodlighting projectors will provide for a minimum of thirty-six different coloured lighting effects, the cycle of which can be varied from day to day. These installations represent the largest illuminated fountain display ever built in the British Isles, and have involved the development of specially designed automatic mercury contact controllers for the colour changing, new pattern submersible floodlight projectors, and other underwater electrical apparatus. Over 700 "Ediswan" submersible floodlight projectors will be installed to house "Royal Ediswan" projector type and standard gasfilled lamps. The load for the lighting installation only will be about 200 kW. Edison Swan tough rubber cables and accessories are being employed throughout for the underwater wiring installation. The Edison Swan Electric Co., Ltd., is working in collaboration with Mr. Campbell Murray, consulting engineer, and Messrs. Crouch & Hogg, civil engineers.

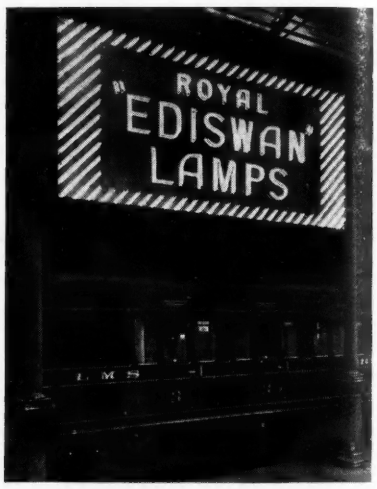
Orders Recently Booked

Britannia batteries have recently been installed at Carradale House, Kintyre, the electrical contractors being Allan, Arthur & Ure, Glasgow, and at Lisore Castle, Co. Antrim, the battery being supplied to the order of J. Starrs, electrical contractor, Ballycastle. Two batteries have been ordered for the Southern Railway Signal and Telegraph Department, Victoria, and one of 60 cells with a capacity of 500 Ah for the photometry section of the National Physical Laboratory, Teddington, for which Britannia Batteries, Ltd., has previously supplied four stationary batteries.

F. W. Brackett & Co., Ltd., Hythe Bridge Ironworks, Colchester, have been awarded a contract by the Clyde Valley Electrical Power Co., for the supply and erection of two central flow band type patent automatic water screens with all accessories, for installation at the Yoker power station, on the recommendation of Messrs. Strain and Robertson, engineers to the company.

Developments in White Neon Lighting

Great strides have been made with the development of white neon tubing during the past few months, and a striking example



A striking effect produced by white "Francora" fluorescent tubing in an "Ediswan" lamp sign at Euston Station

is now to be seen at a "Royal Ediswan" lamp sign installed at Euston Station, London. The sign was constructed by the Franco-British Electrical Co., Ltd., who employed their new "Francora" fluorescent tube system.

Canadian National Exhibition

This year will be the diamond jubilee of the Canadian National Exhibition at Toronto and to mark the occasion the United Kingdom Government has accepted an invitation to organise a special exhibit. A large building has been placed at its disposal by the Exhibition authorities and this, after adaptation and with the addition of a new façade, will become the United Kingdom Government Pavilion. The general theme chosen for the exhibits is the development of communications and transport and the part that they have played in improving the contact between different British countries throughout the world. The Travel and Industrial Association of Great Britain and Ireland will have a stand in the Government Pavilion. The Pavilion and the exhibits are being organised by the Department of Overseas Trade in London. It is understood that arrangements for the British manufacturers' section are progressing favourably.

Woman's Fair and Exhibition

The Woman's Fair and Exhibition, the first of its kind in this country, will be held at Olympia from November 2nd to 26th. The scope of the Fair will cover every aspect of modern women's interests, and will include heating, lighting, domestic science and cookery.

Trade Announcements

Aidas Electric, Ltd., has removed to a modern factory at Sadia Works, Rowdell Road, Northolt, Greenford, Middlesex (telephone: Waxlow 1607. Telegrams: Aidaselect, Greenford, Middlesex). The new factory has been designed for the exclusive manufacture of electric water heaters.

Wilec, Ltd., have removed their headquarters to Wilec House, 90-96, City Road, E.C.1 (telephone: Clerkenwell 6006).

Jackson & Culwick have removed to Empire House, Great Charles Street, Birmingham, 3.

Rich & Pattison (Birmingham), Ltd., are removing on March 25th to 81, Jamaica Row, Birmingham.

New Switchgear Works

The Switchgear and Equipment Co., Ltd., is to build new works at Southam Road, Banbury, at a cost of between £16,000 and £20,000. At present the company has two works in the town, and on the completion of the new factory the present Station Road works will be closed, but the Swan Close works will be continued for another two years. Mr. A. G. H. Oxley, managing director, states that the company intended to go forward with the construction of the new factory in the early part of last year, but that owing to the rise in steel prices the matter was left in abeyance. Recently it has secured a large number of new contracts which has made the building of a new factory imperative, although the price of steel is still too high for economic building. The floor space in consequence will be kept down to the minimum until prices ease, when extensions will be undertaken.

Social Events

On Friday last at the Assembly Rooms, Willesden, over 180 members of the Willesden and London office staff of the Lancashire Dynamo & Crypto, Ltd., with their friends, enjoyed an evening of dancing and games. A short cabaret also enlivened the proceedings. The Foster Engineering Co., Ltd., whose activities were linked with the company last year, was represented by Mr. R. Ely (works director). Mr. H. W. Bosworth (managing director, L.D.C., Ltd.), Mr. C. R. Shaw (director, Willesden Works), and Mr. J. G. Shaw (chairman, Crypton Equipment, Ltd.) also attended.

The athletic section of the Henletel Social and Athletic Club (Henley's head office) would like to get in touch with similar organisations in the electrical industry with a view to arranging track and other fixtures for the 1938 season.

Prices of Materials

Henry Gardner & Co., Ltd., report, March 16th :— Copper bars (best selected), sheet and rod, no change. English pig lead, £19, £1 15s. increase. Spelter, £15 1s. 3d., £1 increase. English block tin, £186 15s., £1 5s. increase. Mercury £12 2s. 6d., 12s. 6d. decrease.

Frederick Smith & Co. report, March 16th : Electrolytic copper bars, £45 10s., 12s. 6d. increase. Ditto, ditto, wire rods, £50 10s., 12s. 6d. increase. Ditto, ditto, h.c. wire, 8¼d., $\frac{7}{16}$d. increase. Silicium bronze wire, 9½d., $\frac{1}{16}$d. increase.

Edward Till & Co. report, March 16th : India-rubber, Para fine, no change.

New Catalogues and Lists

Revo Electric Co., Ltd., Tipton, Staffs.—A leaflet dealing with the new "Pilot" iron.

Electric Lamp and Supplies Co., Ltd., 21, Newman Street, London, W.—A list of the company's electric lamps.

Pressed Steel Co., Ltd., Cowley, Oxford.—Seven new sales booklets have been prepared dealing with refrigeration in the ice-cream trade and milk bars, dairy trade, meat trade, fish trade, cooked meat and provision trade, licensed and catering trades, and public and private institutions.

True Screws, Ltd., 95, Clerkenwell Road, London, E.C.1.—A list of screw-nuts and general automatic repetition work turned from bar.

Foster Engineering Co., Ltd., Apex Works, South Wimbledon, London, S.W.19.—A 52-page illustrated cut catalogue dealing with switch- and fuse-gear and air-cooled bell and low-voltage transformers.

Belling & Co., Ltd., Bridge Works, Southbury Road, Enfield.—A complete catalogue of electric fires with wash-drawing illustrations.

Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2.—A technical folder dealing with lightweight transmitting-receiving equipments; also a leaflet describing a standard signal generator.

Siemens Electric Lamps & Supplies, Ltd., 38/39, Upper Thames Street, London, E.C.4.—An illustrated list of "Sphere" lighting fittings.

Kniveton Cable Works, Ltd., Queensway, Enfield.—A leaflet illustrating a torch for use by doctors, dentists, &c.

Hoffmann Manufacturing Co., Ltd., Chelmsford.—A booklet describing the 40 years' progress of the company and the development of the bearing industry.

S. Wolf & Co., Ltd., Pioneer Works, Hanger Lane, Ealing, W.5.—Details of a new light production ¼ in. drill with ball bearings.

Croydon Engineering Co., Ltd., Syncroy Works, Commerce Way, Purley Way, Croydon.—A list of rotary convertors.

Phosphor Bronze Co., Ltd., 54, St. Thomas Street, London, S.E.1.—A booklet dealing with "Compo" oil-retaining bearings.

W. Edwards & Co., Allendale Works, Vaughan Road, Loughborough Junction, London, S.E.5.—A list of low-priced 50-h.p. motors, &c.

British Insulated Cables, Ltd., Prescot.—A list of steel cored aluminium conductors for overhead power lines and a leaflet dealing with bell wires.

Renold & Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester, 20.—A leaflet dealing with chain push-pull remote control.

Turners Asbestos Cement Co., Trafford Park, Manchester 17.—A folder on "Tac" polished aluminium alloy finish.

British Oxygen Co., Ltd., Thames House, Millbank, London, S.W.1.—Details of "Prana" non-rusting woven wire mesh hose and cable covering.

F. C. Heayberd & Co., 10, Finsbury Street, London, E.C.2. have introduced a house journal known as the "Heayberd Review."

Private Arangements

F. C. Garrett, electrical and radio engineer, 40-42, Chapel Street, Luton.—A meeting of the creditors was held recently at Luton, when Keens, Shay, Keens & Co., I.A., 11, George Street West, Luton, submitted a statement of affairs which showed ranking liabilities of £2,616. The net assets were £1,561, leaving a deficiency of £1,055. It was decided that the matter should be dealt with under a deed of assignment to Mr. P. Keens, and Mr. C. Latham of 185-8, High Holborn, London, W.C,. as joint trustees, with a committee.

A. R. King, 18, Ber Street, Norwich, radio dealer, &c.—The statement of affairs submitted at the recent meeting of creditors disclosed ranking liabilities of £727. The net assets were £103, leaving a deficiency of £624. The creditors passed a resolution in favour of the matter being dealt with under a letter of authority to Mr. W. Howard, 2, Redline Street, Oxford Place, Norwich, to realise the assets and distribute the proceeds *pro rata* among the creditors.

F. T. Butler, trading as "Victor Radio," High Street, Rayleigh, formerly at Billericay and Hadleigh, Essex, radio dealer, &c.—The creditors were called together recently when a statement of affairs was submitted which showed ranking liabilities of £2,427. The net assets were £150, leaving a deficiency of £2,277. In the absence of any offer it was decided that the matter should be dealt with under a deed of assignment to Mr. W. A. Smith, 2, Green Lanes, Palmers Green, with a committee.

Bankruptcy Proceedings

F. S. Moses, 9, Thorney Lane, Midgley, near Halifax, formerly carrying on business at 8, Bank Side, Hebden Bridge, and at 9, Thorney Lane, Midgley, electrical contractor.—Insufficient business was stated to be the cause of this debtor's failure when he attended for his adjourned public examination at the County Court, Prescott Street, Halifax, recently. His deficiency amounted to £210. The examination was closed.

J. F. B. Wallen (trading as Auto Radio, Co.), 191, Elgin Terrace, Maida Vale, W., radio dealer.—The first meeting of creditors under this failure was held on March 9th at London Bankruptcy Buildings. The Official Receiver reported that according to debtor's preliminary statements he began business in May, 1936, with a free capital of £200 and a loan of £70 from his mother. The trading principally consisted of supplying car radio sets to the trade, but a small retail business was also carried on. In November last there was a burglary, when stock and equipment to the value of £400 was stolen and was never traced. His credit having been stopped at that time the debtor gave cheques in advance in payment for goods and certain of the cheques having been dishonoured. he closed the business. The liabilities amounted to £1,800. and in the absence of assets the case was left with the Official Receiver to be wound up in bankruptcy. The failure was attributed to loss by the burglary and to heavy advertising expenses.

W. F. Buttery, 34, Holme Lane, Dudley Hill, Bradford, formerly carrying on business at 293, Tong Street, Dudley Hill, electrical contractor and wireless dealer.—The public examination herein was held at the County Court, Bradford, on March 10th, and according to the statement of affairs returned there were gross liabilities of £591 and net assets of £90, leaving a deficiency of £501. Debtor attributed his failure to intensive competition by bigger concerns, under-estimating, insufficient turnover, and bad debts. The examination was closed.

W. E. Sparrow and **F. Sparrow,** carrying on business under the style or firm of Sparrow & Co., 8, Longsmith Street, Gloucester, electrical contractors.—The public examination was recently held at the Shire Hall, Gloucester, when the joint statement of affairs showed gross liabilities of £2,067. The assets were put down at £354 and there was a deficiency of £967. The Official Receiver asked for an order for debtors to supply a cash account for the three years preceding the bankruptcy. Debtors attributed their failure to want of capital and losses on contracts through lack of supervision. The Registrar made an order for a cash account and the examination was adjourned.

R. D. Farrant (lately trading as Ferrex Radio), 543, Holloway Road, N., formerly radio manufacturer and dealer and now director of a company.—The first meeting of creditors under this failure was held on March 10th at London Bankruptcy Buildings before Mr. C. T. Newman, Assistant Official Receiver. A statement of affairs was presented showing liabilities of £670 and assets £4. The debtor attributed his failure to the collapse of Ferrex Radio, Ltd. The case was left in the hands of the Official Receiver to be wound up in bankruptcy.

J. R. Brightwell, electrical contractor, 107, Queen's Road, W.2.—Last day for receiving proofs for dividend March 22nd. Trustee, Mr. P. Phillips, 14, Langham Street, Portland Place, W.1.

B. A. E. Hinkins, radio dealer, 322, Torquay Road, Paignton.—Application for discharge to be heard on April 12th at the New Town Hall, Torquay.

B. Downing (Magneto Service Co.), deceased, lately trading at 51, Grafton Place, Leicester.—Last day for receiving proofs for dividend March 18th. Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

N. R. Neale, wireless dealer, 22, Hemlett Road, Cheltenham.—First and final dividend of 2s. 6d. in the £, payable March 23th at 26, Baldwin Street, Bristol.

Company Liquidations

Reveal Trading Co., Ltd., wholesale dealers in wireless supplies, 67, Rosoman Street, London, E.C.1.—The creditors were called together recently when a statement of affairs was submitted which showed ranking liabilities of £3,042, of which £2,866 was due to the trade and £176 to cash creditors. The net assets were £484, leaving a deficiency of £2,558, so far as the creditors were concerned. The creditors decided to confirm the voluntary liquidation of the company and also appointed a committee of the principal creditors.

Hydro-Electrical Treatments, Ltd.—Winding up voluntarily. Liquidator, Mr. F. S. Kott, 16, John Dalton Street, Manchester.

Dissolution of Partnership

Ward & Nobes, electrical engineers and contractors, South Road, Bishop's Stortford.—Messrs. A. J. Nobes and T. A. Ward have dissolved partnership.

Electricity Supply

Lighting, Domestic, Power

Belgium.—CO-ORDINATION.—An interesting development in Belgium is the possibility of a complete co-ordination under the Société pour la Co-ordination de la Production et du Transport d'Énergie Électrique en Belgique. Its studies are being directed towards a complete rationalisation of production and transmission of energy, and the various producers have agreed not to increase the capacity of their plants nor to build new ones without its approval. The C.P.T.E. hopes to be able to utilise sources of energy now wasted, particularly blast-furnace gases, and to encourage the interconnection of the various networks so as to bring them into a single operating unit. The programme involves a considerable power network, as the plants which will come under its control have an aggregate installed capacity of 2,100,000 kW and produce some 5,000 million kWh annually. The C.P.T.E. itself will not operate the plants, but will confine its activity to the construction and operation of metering sub-stations at the points of connection and the maintenance of communication systems between producing plants.

Blackburn.—ESTIMATED PROFIT.—At a meeting of the Town Council on March 7th it was stated that the net profit on the Electricity Department during the present financial year was estimated at £11,835. For the ensuing financial year it was computed that there would be a profit on the undertaking of £3,453. The chairman of the Finance Committee said that the position of the Gas Department gave rise to some anxiety. Evidently it was feeling the effect of competition with the Electricity Department, which appeared to be inevitable. The position would be eased in three years time when, by the operation of the sinking fund, a large loan would have been paid off.

Bolton.—SUB-STATION.—The Town Council is to erect a sub-station in Folds Road.

Brighouse.—LOAN.—Sanction is being sought by the Town Council to borrow £4,000 for mains.

Burton-on-Trent.—RURAL SUPPLIES.—The Electricity Committee is to extend its mains to supply the Tutbury and Anslow rural area.

Clitheroe.—OBJECTION TO OVERHEAD LINE UPHELD.—An objection made by the Rural District Council to the proposed erection of an overhead line in Wiswell Lane, Whalley, by the Lancashire Electric Power Co. has been upheld by the Minister of Transport.

Clydebank.—STREET LIGHTING CONVERSION.—At its recent meeting the Town Council approved in principle a scheme to convert the street lighting of the burgh from gas to electricity at an estimated cost of £17,000.

Colchester.—CHANGE-OVER.—The Town Council has approved a scheme for changing over the system of supply in Lexden Road and certain other roads in the neighbourhood from d.c. to a.c. The Council has also authorised the electrical engineer to lay a new cable from the North Hill sub-station to the corner of Sheepen Road at an estimated cost of £830 in order to maintain an adequate pressure of supply. This cable will be available for general distribution when a change-over is decided upon.

Darlington.—THREE-PHASE SUPPLY.—Application is to be made to the Electricity Commissioners for sanction to borrow £12,320 for changing over the supply in the Cleveland Terrace area from single-phase to three-phase.

East Ham.—WATER HEATING IN SCHOOLS.—It is possible that electric water heaters will be installed in several schools, the borough electrical engineer having submitted an estimate to the Education Committee.

TRACTION SWITCHBOARD.—The Electricity Committee is to supply a traction switchboard for the Nelson Street power station at a cost of £838.

PARK LIGHTING.—Consideration is being given to the question of installing a system of lighting in the Central Park with a view to illuminating a certain portion during the summer months.

Ebbw Vale.—BETTER LIGHTING.—The Council has decided to improve the public lighting in the town and is to spend £2,274 on a high-pressure mercury-vapour lamp installation.

Finchley.—LOW WATER-HEATING TARIFF.—The Electricity Committee has recommended a special tariff for off-peak water-heating supplies which are disconnected between 4.30 and 7.30 p.m. during November, December, January and February. The proposed flat rate is 0.375d. per kWh, subject to a coal clause and to the total installed water-heating load being not less than 10 kW, the consumer providing, at his own expense, the necessary time switch.

DISTRIBUTION.—In connection with the change-over, proposed plans involve an expenditure of £20,000. A sum of £11,361 is also to be spent on mains extensions. A sub-station is to be erected on the Reeds estate, Hampstead Garden Suburb.

Fort William.—CALEDONIAN POWER BILL.—It was reported to the Town Council recently that the second reading of the Caledonian Power Bill would take place in the House of Commons on March 23rd. A deputation of the Council is visiting London to urge support for the Bill.

Gateshead.—SUPPLY TO ESTATE.—The North-Eastern Electric Supply Co., Ltd., is to lay cables on the estate adjoining Southend Road, Sheriff Hill.

Gravesend.—ALLOCATION OF SURPLUS.—Subject to the approval of the Electricity Commissioners where required, the surplus of £14,006 on the working of the electricity undertaking during the past year is to be allocated as follows: Capital expenditure, £6,288; in aid of local rates, £4,877; and income-tax reserve, £2,841.

Grimsby.—EXTENSION TO SALTFLEETBY.—The Electricity Committee has decided to extend its supply to Saltfleetby. The cost will be £8,210.

Hastings.—STREET LIGHTING.—The Electricity Committee is to improve street lighting at a cost of £1,079.

Hebden Royd.—LOAN FOR APPARATUS.—Application is being made by the Urban District Council for sanction to borrow £3,000 for the purchase of cookers and other electrical apparatus let out on simple hire by the Council.

Hove.—CABLES.—The Electricity Committee is applying for permission to borrow £2,000 for cables.

Japan.—CO-ORDINATION PLAN.—Officials of the Communications Ministry have issued the following explanation of their plan for bringing the electrical utilities under one control: The Government is to set up a special body of electric power

The McLellan Memorial

Engineers from all parts of the country paid tribute on March 11th to the late Colonel William McLellan, C.B.E., originator of the Galloway power scheme, to whose memory a plaque was unveiled by the Convener of the county. Prior to the ceremony a party of guests of the Galloway Water Power Co. were conveyed on a tour of inspection of the company's undertaking. The undertaking has now been in commercial operation for sixteen months and has proved it can develop a greater output than that for which it was originally designed, namely, about 107,000 kW against a designed capacity of 102,000 kW. For 1937, notwithstanding wide variations in weather conditions, ranging from exceptional flood to drought, it took over a peak load every day from the grid, as required, and generated 200 million kWh against the estimate of 182 million kWh per annum. The ceremony in connection with the unveiling of the memorial took place at the power station at Tongland. The guests were received by Lord Meston, chairman of the Galloway Water Board Co., accompanied by Mr. F. H. Williams, manager, and other officials of the company. Relatives, friends and others who were closely associated with the late Colonel McLellan were present, as well as partners and members of the firm of Merz & McLellan, and representatives of Sir A. Gibb and Partners, consulting engineers to the Galloway Water Power Co. Lord Meston, who presided at the ceremony, said it was not perhaps generally known that the first idea of the Galloway scheme was conceived in the brain of a patriotic Gallowegian, the late Colonel William McLellan. It was his close knowledge of the country, coupled with his engineering skill and courage, which brought the project into being and he nursed it with care and devotion until his death. To some of his friends and former colleagues it seemed that the work would be incomplete without some link that would connect it with his memory; and hence the tablet, eloquent in its simplicity and thus characteristic of the man. Captain Wickham-Weeks, of Barholm, Convener of the Stewartry of Kirkcudbright, unveiling the tablet, took the opportunity of saying how much the County Council and its Electricity Committee were indebted to Colonel McLellan for his kindness and advice in the early days of electricity in the county. Mr. C. Merz, moving votes of thanks, said that all those in any way associated with Colonel McLellan, not only in his work in Galloway but on other important work which he did throughout the world, would appreciate more and more the kindly thought the company had in erecting the plaque to his memory.

experts within a year after the passage of the Electric Power Bill. This new company will take over all business in connection with electric power developments from the hands of the Government officials. The proposed Electric Power Generation and Transmission Company will start business on April 1st, 1939. In the first year of operation the company is expected to supply power on a wholesale basis to the extent of 3,300,000 kWh, but this will be increased to 7,300,000 kWh within ten years. It is expected that the wholesale rate for power will be 1.5 sen per kWh in the first year, as against the average rate of 1.8 sen now. The rate is expected to be lowered to 1.1 or 1.2 sen after ten years. The company will be capitalised at 805 million yen, with 780 million yen investments in kind and 25 million yen cash down (a quarter of the new shares will be offered for public subscription). Construction expenses during the period of ten years are estimated at 1,850 million yen. This amount will be met by calling for unpaid portions of the subscribed capital, by issuing debentures and by temporary loans. The capital of the company will not be increased. It is expected that the company will be able to declare dividends at the rate of 6 per cent. per annum for the first business year and at 7 per cent. ten years later. It is provided that the Government shall guarantee 4 per cent. annual dividends for the sole purpose of averting uneasiness of the public in connection with the business of the new company. The Government, however, appears to believe that the company will be able to pay 6 per cent. even for the first business year without aid.

London.—ST. MARYLEBONE.—Switchgear and cabling is to be provided at a cost of £5,533 in connection with the Hampstead bulk supply.

FULHAM.—The borough electrical engineer has been offered advertising facilities at the Regal Cinema, Walham Green, and has arranged to purchase 100 ft. of suitable film, which will be shown three times each day every other week for a year. The total cost will be between £100 and £130 for the year, which works out at approximately 3s. 9d. per showing, to probably an average of 1,500 people. The Electricity Committee is of the opinion that the proposed film represents a cheap and telling form of advertising.

With the object of making a comparison between the policy of fitting a transmitting and receiving apparatus as against receiving apparatus only, the S.S. *Fulham* was fitted with radio telephones, and radio receiving sets only were fitted on the *Fulham II.* and *Fulham III.* The borough electrical engineer reports that it has been found during the past winter that the steamer fitted with transmitter and receiver apparatus has a definite advantage over the others, and he has therefore recommended that transmitting and receiving telephones shall be fitted on the other ships.

The borough electrical engineer has been investigating for some time the possible alternatives to hydrated lime, which costs 38s. a ton, and he has now obtained a tender from the British Oxygen Company, Ltd., for the supply of lime putty, which is a waste product at present dumped by the company into settling pits at its works. He states that a method has been evolved of pumping this lime putty into suitably designed lorries for transport to the power station, and that the company has quoted a price of 3s. 6d. per ton for the lime putty loaded free into vehicles at its works, plus 4s. 6d. a ton for cartage during normal working hours on week-days, or 6s. on Sundays, Christmas Day or Good Friday. The cost of the lime putty per ton of coal (containing 1.5 per cent. sulphur) burnt works out at 6¾d., and hydrated lime at 1s. 4¾d., and on the basis of the present consumption of coal the saving will be £120 per week. It will, however, be necessary to carry out modifications to the temporary lime plant at the station at a cost of £750.

The Central Electricity Board has agreed to pay a rental of £1,106 per annum for a sub-station site at Gloucester Wharf.

The consulting engineers and the borough electrical engineer have submitted reports with regard to the Thames Barrage Scheme, and they have expressed the opinion that it would be detrimental to the power station as regards condensing water and impracticable as regards the Council's colliers. The Electricity Committee is therefore of the opinion that the Council should oppose the proposals of the Thames Barrage Association, and for this purpose it should join with the other undertakings concerned.

REDUCED FLAT RATE.—The County of London Electric Supply Co., Ltd., has reduced its flat rate for lighting from 5½d. to 5d. per kWh over a wide part of its areas, including Romford, Upminster, Hornchurch, Woodford, Loughton, Epping, Mitcham, Sanderstead, Morden, Kenley, Selsdon, Beddington, Coulsdon, Purley, Caterham, Woldingham, Chipstead, and Merstham.

LIGHTING OF TENEMENT STAIRCASES.—The Metropolitan Boroughs' Standing Joint Committee has had under consideration a request from the Southwark Borough Council that powers should be obtained to enable Metropolitan Borough Councils to require the provision of lighting of staircases in tenement buildings, and has asked the London County Council to promote the necessary legislation to secure such lighting from one hour after sunset until 11 p.m.

Lowestoft.—METERS.—Sanction has been obtained by the Electricity Committee to borrow £2,222 for the purchase of second-hand meters.

Manchester.—COUNCIL HOUSE INSTALLATIONS.—The Housing Committee has rejected a request for the installation of electricity in certain houses taken over from the Bucklow R.D.C. and at present illuminated by gas. Tenants have been given permission to install electricity at their own expense to the satisfaction of the Corporation, or, alternatively, to make their own arrangements with the Electricity Department under the assisted-wiring scheme.

Newark-on-Trent.—CHEAPER ELECTRICITY.—The Electricity Committee has adopted the following reduced scale of charges: Lighting flat rate, 4d. per kWh; late-hour shop-window lighting 1d. per kWh; power, 1½d. per kWh for the first 1,000 kWh per quarter and 1d. per kWh for all in excess. There are also reductions to e.h.v. power consumers and others under special agreement, and there will be an increase of discount to l.v. consumers from 10 to 12½ per cent.

Norwich.—INAUGURATION OF POWER STATION EXTENSIONS.—More than 200 guests attended the banquet held at St. Andrew's Hall, Norwich, on March 10th to celebrate the opening of the power station extension, which we described and illustrated in our last issue. Mr. V. Alexander Pask, city electrical engineer, thanking the contractors for the excellent job they had done, said they had completed the undertaking in the scheduled time despite the difficulty of obtaining steel owing to the Government's rearmament programme. Mr. G. Summers, of the Stirling Boiler Co., Ltd., and Mr. G. Bedford, of C. A. Parsons & Co., Ltd., briefly acknowledged Mr. Pask's tribute. Mr. C. G. Morley New, Electricity Commissioner, mentioned that Norwich supplied the largest area of any municipality in England. Referring to the fact that at the end of March, 1937, Norwich was supplying 47 per cent. of the possible demand in the rural areas, and 89 per cent. of that in the urban area, Mr. New said he wished they would break down this barrier between rural and urban supply. It was all in their area, and, as far as he could see, there was a great community of interest between the urban and rural areas. Mr. S. A. Bailey, chairman of the Electricity Committee, said that even further progress in the district was to be attempted. On March 15th a revised scheme for workshops and stores, to cost £74,000, would come before the City Council. They also hoped soon to submit proposals for showrooms in a more central part of Norwich. The Lord Mayor of Norwich (Mr. C. Watling) spoke, and Mr. W. J. Bache, president of the I.M.E.A., briefly responded to a toast to the guests.

Peterhead.—ELECTRIC STREET LIGHTING.—At a recent meeting of the Town Council a recommendation for the extension of street lighting by electricity at a cost of £908 was adopted. It was also decided to borrow £5,000 to meet the capital expenditure in connection with the installation of electric street lighting.

Plymouth.—SECONDARY LIGHTING NECESSARY.—The city surveyor recently reported to the Estates Committee that the magistrates had made it a condition of the granting of licences for certain halls belonging to the Council that secondary lighting should be provided, and that he had made provision in the estimates for the work to be carried out.

Preston.—EXTENSION.—The Town Council proposes to afford a supply of electricity to Westby-with-Plumpton at an estimated cost of £3,295.

Ramsgate.—PURCHASE OF UNDERTAKING TO BE CONSIDERED.—The Town Council has appointed a sub-committee to consider whether the Ramsgate and District Electric Supply Co., Ltd., shall be required to sell its undertaking to the Corporation.

Retford (Notts).—REDUCED CHARGES.—Lower electricity charges have been announced by the Corporation, including a reduction of 1d. per kWh in the lighting flat rate to 5d. in the borough and 7d. in the rural area.

Rugby.—METERS.—The Electricity Department is to invite tenders for meters.

Rushden.—DISTRIBUTION WORKS.—The Rushden and District Electric Supply Co., Ltd., is to lay cables in Moor Road between Montague Street and Pemberton Street and erect a sub-station off Skinner's Hill.

South Shields.—MAIN-ROAD LIGHTING.—Having further considered the question of improving the lighting on traffic routes, the Lighting Committee has agreed to install 250-W electric-discharge lamps at a cost of £2,083.

Spalding.—RURAL SUPPLIES.—The Ministry of Transport has approved the extension of low-voltage overhead lines in Pinchbeck Road, Spalding; Spalding Road, Pinchbeck; and in Donington Northorpe. An electricity supply will shortly be available at Gedney, Gedney Hill and Whaplode Drove.

Stretford.—IMPROVED LIGHTING.—Appreciation of modern developments in electric street lighting, expressed in a speech by the chairman of the Stretford Highways Committee, is recorded in a recent issue of the *Stretford Argus*. In connection with improvements in street lighting which are being made in the borough the chairman said that the Committee's conclusions as to the efficiency of the new method of lighting were confirmed and a comprehensive scheme had been drawn up. The new method referred to is the electric-discharge lighting which Stretford is adopting extensively. The contract for the first section to be completed—a length of 1½ miles of Barton Road—was obtained by the Metropolitan-Vickers Electrical Co., Ltd., and the arrangement adopted utilises horizontal type mercury lamps which do not require any external control of the arc. The installation includes ninety-four 250-W lamps, spaced 110 ft. apart and mounted 25 ft. above the road on 16-ft. brackets. The lamps are arranged in "Metrovick Liverpool" lanterns, which are of the definite cut-off type, and

the result is practically glareless lighting combined with excellent distance visibility. The installation comes under the B.S. Specification for Class D lighting.

Swansea.—CONTRACT CLAIM SETTLED.—The Electricity Committee has agreed to a settlement of £7,000 in regard to a claim for £10,949 for extras in connection with the Tir John power station building contract. The Committee has also resolved that the necessary steps shall be taken for affording a supply of energy to Imperial Chemical Industries, Ltd., at an estimated cost of £61,450, and sanction is to be sought to the necessary loan.

EQUIPMENT.—The Electricity Committee is to provide mains and sub-stations at an estimated cost of £15,112.

Sweden.—NEW POWER STATIONS.—The Government has submitted a proposal to the Riksdag for the construction of a new 85,500-kW hydro-electric power station at Torpshammar, on the Gimaan River, in Norrland, reports *Reuter's Trade Service* from Stockholm. The cost is estimated at Kr.20,000,000, and for the next financial year Kr.300,000 is required for preparatory work. Construction will take six years. The engine hall will be 120 metres below the ground. A large new private water-power station on the Dalälven River will soon be completed. It has two sets of machinery, with a total capacity of 80,000 kW. The cost will be Kr.10,000,000. One of the sets will be started next autumn, and the second about the end of the year.

ELECTRICAL CONSUMPTION.—Preliminary figures now published indicate that the consumption of electricity in Sweden during 1937 amounted to over 8,000 million kWh. Industrial use and railway electrification have been the principal factors contributing to the quantitative increase, but domestic consumption has also made rapid progress and provided the biggest increase in revenue.

Torquay.—STREET LIGHTING.—The Highways Committee is to light Torwood Street and Babbacombe Road with mercury-vapour lamps at a cost of £1,800.

United States.—AIR-CONDITIONING DEMAND INCREASES.—More air-conditioning installations than ever before were brought into use in Chicago last year, it is reported, the total of 575 (capacity 12,556 h.p.) comparing with 432 (8,719 h.p.) in 1936. The number of air-conditioning plants installed or contracted for in Chicago at December 31st, 1937, was 1,923 and the total capacity was 70,207 h.p.

NEW CONSTRUCTION.—According to the *Electrical World*, some of the principal utilities are planning construction on a considerably larger scale this year. The budget of $18,000,000 of the Detroit Edison Co. is greater than for any year since 1930, and includes $7,900,000 on generating equipment. The United Light and Power Co., American Light and Traction Co. and their subsidiaries propose to spend a similar amount, which will include $5,000,000 on power-house plant for the Columbus and Southern Electric Co.

Wallasey.—TARIFF CHANGES.—The Electricity Committee proposes to alter the electricity charges. The new rates are as follows:—Domestic two-part tariff: unit charge 0.33d. per kWh. Ordinary lighting up to 500 kWh per quarter, 2¾d. per kWh; 500 to 1,000 kWh at 2½d.; 1,000 to 1,500 kWh at 2¼d.; and all in excess at 1¾d. Lighting (prepayment meter): 3d. per kWh.

PROPOSED SUB-STATIONS.—The Electricity Committee has obtained sub-station sites at the Breck and at Broadway Avenue.

LOAN FOR APPARATUS.—Application is being made for permission to borrow £20,000 for appliances to be offered on hire-purchase terms.

Walsall.—SUB-STATION.—The Town Council is to build a sub-station in Eldon Street.

Washington (Co. Durham).—STREET-LIGHTING CHARGES.—The Urban District Council has decided to ask the North-Eastern Electric Supply Co., Ltd., to reduce its charges for street lighting.

Wellingborough.—STREET LIGHTING.—The Urban District Council has discussed the question of improved street lighting from the financial angle, and the Highways Committee is now to consider the advisability of raising a loan of £2,769 for the new lighting planned for Northampton Road, part of Croyland road, and London Road.

West Hartlepool.—IMPROVEMENTS TO SUPPLY.—The Town Council proposes to spend £5,190 on improving the supply.

MAINS.—Application is to be made for sanction to borrow £10,000 for mains.

Weymouth and Melcombe Regis.—SUB-STATION.—The Town Council is to erect a transformer sub-station at Bowleaze Coveway, Overcombe.

Whitby.—LOANS.—The Urban District Council has decided to apply to the Electricity Commissioners for permission to borrow £3,000 for cookers and domestic apparatus, £2,000 for mains and services, £1,000 for meters, and £5,000 for the change-over of supply.

Wirral.—DISTRIBUTION.—Representatives of the Birkenhead, Wallasey, and Hoylake Councils and technical experts appointed by the Cheshire County Council have held a meeting to discuss electricity distribution in the Wirral. The Wallasey Electricity Committee has resolved that in view of the report of the Town Clerk collaboration with authorities outside Group No. 16 shall be deferred pending the publication of the Government Bill, and that the borough treasurer and the electrical engineer shall be authorised to examine the feasibility of a scheme for electricity distribution embracing the Wallasey, Birkenhead, and Hoylake undertakings and to discuss the question jointly with the financial and technical officers of those authorities.

Wolverhampton.—DEVELOPMENT.—An additional transforming centre is to be provided off Compton Road at a cost of £1,285, and mains are to be extended at a cost of £736.

Workington.—SUB-STATION.—The Electricity Committee is to purchase land at Annie Pit for a sub-station.

SUPPLY TO COLLIERY.—Terms have been arranged for a supply of electricity to the Solway Colliery for the United Steel Co.

York.—BETTER LIGHTING.—An estimate of £550 from the Electricity Department for an improved lighting scheme for Haxby Road has been approved.

Traction

Glasgow.—CONSIDERATION OF TROLLEY-BUSES.—A sub-committee of the Transport Committee last week asked the manager to report on the subject of trolley-buses and decided that a deputation should visit Manchester and London, where trolley-buses are in use. It was also suggested that London Passenger Transport Board experts should be invited to Glasgow to examine the city's streets and to state whether they are suitable for trolley-buses.

London.—INTERRUPTION OF UNDERGROUND RAILWAY SERVICES.—On Tuesday the services on sections of the London Underground Railways were disorganised by the breakdown to earth of a d.c. cable running from the sub-station at Charing Cross to the track at Lambeth North. The damage was such as to entail the laying of a new cable. The sections affected were those between Piccadilly Circus and the Elephant and Castle on the Bakerloo and between the Strand and Kennington on the Northern line. Normal conditions were restored on the latter at about 10 a.m. and a partial service was given on the Bakerloo shortly afterwards. Through running on the Bakerloo was complete by 2 p.m., except that Lambeth North station remained closed to permit of work being carried out there.

NEW TUBE TRAINS.—We are asked to make it clear that the motors for the new L.P.T.B. tube trains are being supplied by the General Electric Co., Ltd., and Crompton Parkinson, Ltd., who are manufacturing eight hundred each. The control equipments for the trains are being supplied by the British Thomson-Houston Co., Ltd., which has sub-contracted, through the Crompton-West organisation, a minor part of its order for manufacture by Allen West & Co., Ltd.

Portsmouth.—FINANCIAL POSITION.—The financial position of the passenger transport undertaking was discussed by the City Council on March 1st, and this discussion was resumed on March 8th. A report presented by the Finance Committee referred to investigations which had been made by the Special Committee and the Passenger Transport Committee. The report asked that the Council should be called upon to lay down a definite financial policy for the undertaking. One of the councillors said that the Council had decided upon a policy of demanding 1½ per cent. from its trading concerns, which was impossible to work. Among the points discussed were the debt on the old tramway system, the purchase of new buses or the reconditioning of old ones, and workmen's fares, and there were a large number of amendments down on the agenda. Eventually a proposal of the Finance Committee "that the undertaking be run at a reasonable profit" was carried by 33 votes to 16.

E.P.E.A. Dinner-Dance

There was an attendance of 220 members and guests at the annual dinner-dance of the Birmingham and district section of the Electrical Power Engineers' Association, held at Edgbaston Botanical Gardens on March 10th. "The Association" was proposed by Alderman W. Walker, chairman of the National Joint Board, who said that the Association had achieved the establishment of a proper relationship between staff and employers, who now met as equals to discuss the problems with which so great an industry was bound to be faced. Whatever difficulties the Association had faced in reaching its present position, he did not believe they had been so great as those of the employers, who had to persuade public authorities to accept the idea of handing over to an outside body the right to fix rates of remuneration and conditions of service. He was glad there was every prospect that at an early date a scheme of apprenticeship would be brought into operation, providing facilities for the boy with a secondary or elementary school education and also for the boy who was able to attend a technical college or take a degree, whose apprenticeship would naturally be shorter.

Replying, Mr. L. Hoskison, president of the E.P.E.A., said the Association was very conscious of the help received from employers, particularly with regard to the training of engineers. The new scheme was a great step forward and would greatly assist young men coming into the industry. Mr. G. G. Heathcock, secretary of No. 5 District Joint Board of Employers and Members of Staff for the Electricity Supply Industry, proposed the health of the ladies, and Mrs. F. Forrest, Birmingham, responded. Mr. H. S. Davidson, chairman of the section, presided.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—March 22nd. County Council. Electrical work at the Waterton estate (twenty-eight houses). County Clerk, 22, Union Terrace.

Aldershot.—April 5th. Electricity Department. Cable and meters for twelve months. (March 11th.)

Australia.—MELBOURNE.—March 29th. Deputy Director, Posts and Telegraphs. Telegraph milliammeters. (T. 18422/38.)*

April 4th. City Council. 530 electricity meters. (T.Y. 18353/38.)*

Blackburn.—March 24th. The Managers. Electric lamps for twelve months for Mental Defectives' Institution, Whalley. C. R. Ikin, clerk and steward.

Bootle.—April 4th. Watch Committee. Sodium electric lighting for Southport Road. (March 11th.)

Brecknockshire.—April 1st. Electric lighting and heating installation at new senior school at Crickhowell. H. C. W. Strickland, Watton Offices, Brecon.

Bridlington.—April 2nd. Town Council. 11-kV switchgear equipment, l.v., a.c. distribution panel and one 500-kVA transformer. (See this issue.)

Darlington.—March 23rd. Corporation. 6,000-V to 400-V transformers. (March 11th.)

Dartford.—March 26th. Borough Council. 1,375 yd. of 11-kV cable. (See this issue.)

Dumfriesshire.—March 21st. County Council. Electrical work at police buildings in English Street. County Clerk.

Dumfries.—March 24th. Electricity Department. Two four-panel h.v. metal-clad switchboards. (March 11th.)

Dundee.—April 6th. Electricity Department. Electric cookers, wash boilers, water heaters, a.c. meters and d.p. switches for one year. (See this issue.)

Egypt.—CAIRO.—April 2nd. Ministry of Public Works. Electrical and pumping plant, travelling cranes, lorries, cables, &c., for Mecca water and power scheme. (T.Y. 18398/38.)*

Farnworth.—March 24th. Electricity Department. One 500-kVA transformer. (March 11th.)

Fife.—March 28th. County Council. Electric lighting installations in twenty houses at Freuchie. County Clerk, Cupar (deposit £1 1s.).

March 21st. Electric lighting at Methil Hill housing estate (108 houses). County Clerk, Cupar (deposit £1 1s.).

Gellygaer (GLAM).—April 2nd. Electricity Department. One electric battery vehicle and one petrol-driven vehicle. (See this issue.)

Great Ouseburn (YORKS).—March 25th. R.D.C. Pumping machinery, including electric motor and automatic switchgear for three pumping stations at Nether Poppleton. Clerk of the Council, Council Offices, Boroughbridge, Yorks (deposit £5).

Hazel Grove and Bramhall.—March 31st. Electricity Department. E.h.v. and l.v. switchgear and booster equipment. (See this issue.)

Heston and Isleworth.—April 2nd. Electricity Department. One 600-kVA transformer, e.h.v. switchgear, milking booster, and special l.v. testing transformer. (See this issue.)

Horsham.—March 26th. Electricity Department. Meter-testing equipment and three 300-kVA, three-phase, oil-cooled transformers. (March 11th.)

Hull.—April 1st. Electricity Department. One thirty-ton weighbridge. (See this issue.)

Iraq.—April 2nd. Government. Four Diesel engines coupled direct to a.c. generators, with all accessories. Royal Iraq Legation, 22, Queen's Gate, London, S.W.7.

Kilmarnock.—March 21st. Town Council. Electric lamps for all Corporation departments. Town Clerk.

Heating and electrical installations at new public baths. T. C. Stewart, surveyor, Clydesdale Bank Chambers.

Littlehampton.—March 23rd. U.D.C. One 15,000-g.p.h. electrically driven submersible borehole pump. Water engineer, Council Offices.

London.—ST. MARYLEBONE.—March 29th. Electricity Department. Work in connection with the laying of stoneware ducts and the drawing-in and jointing of h.v. cables in streets. (See this issue.)

Lowestoft.—March 24th. Electricity Department. Cable and three indoor type transformers. (March 11th.)

Manchester.—March 25th. Electricity Committee. Cables and service cut-outs for twelve months. (March 11th.)

March 19th. 6.6-kV, three-phase, a.c. switchgear for Dickinson Street "B" sub-station. (March 11th.)

March 31st. Electricity Department. Static transformers for twelve months.

April 20th. Coal-dust collecting plant for Barton power station. (See this issue.)

Mansfield.—April 12th. Meden Valley Waterworks Committee. One 460-kVA three-phase transformer for Budby pumping station and one 125-kVA three-phase transformer, e.h.v. switchboard, and m.v. switchboard for Stoney Houghton pumping station. (See this issue.)

Middlesex.—April 11th. County Council. Two X-ray units and equipment for the Redhill County Hospital, Edgware. (See this issue.)

Milford Haven.—March 21st. Electricity Department. Materials for twelve months. (March 11th.)

Newburn-on-Tyne.—U.D.C. Installation of electric lighting in 156 houses at Westerhope. Surveyor.

Newport.—April 21st. Electricity Department. Two water-tubs boilers and accessories. (See this issue.)

New Zealand.—WELLINGTON.—April 29th. Posts and Telegraph Department. P.i. telephone cable. (T. 18304/38.)*

April 28th. One automatic voltage regulator. (T.Y. 18120/38.)*

May 4th. Telephone cable. (T.Y. 18645/38.)*

April 20th. 100 batteries. (T. 18643/38.)*

April 27th. 1,100 secondary cells. (T.Y. 19186/38.)*

April 12th. Public Works Department. 11,000-V, 400-V multicore, and telephone cable. (T. 19185/38.)*

June 28th. Public Works Tenders Board. Nine 110-kV single-phase potential transformers and accessories, and nine auxiliary transformers. (T.Y. 19187/38.)*

Portsmouth.—April 11th. Electricity Undertaking. Meter-testing equipment. (See this issue.)

Reigate.—April 1st. Electricity Department. Materials for twelve months. (See this issue.)

South Africa.—PRETORIA.—March 31st. Public Works Department. Two vertical discharge centrifugal sewage pumps and two high starting torque squirrel-cage motors. (T.Y. 18737/38.)* Thirty-four electric synchronous clocks. (T.Y. 18736/38.)*

CAPE TOWN.—March 31st. Electricity Department. Insulated copper wire. (T. 18397/38.)*

March 29th. 15,000 50-A pole fuses, with accessories and 500 50-A and 1,000 25-A d.p. ironclad service cut-outs.

March 23rd. Electricity Supply Commission. Insulators. (T. 18450/38.)* 26,440 lb. of hand drawn copper wire. (T. 18400/38.)* Electric light poles, pole fittings and six miles of galvanised steel stay wire. (T.Y. 18401/38.)*

April 20th. House service electricity meters. (T. 19146/38.)*

PORT ELIZABETH.—March 24th. Electrical Engineer's Department. Switchgear, street pillars, kiosks, transformers, switchboard, cable and copper wire. (T.Y. 19019/38.)*

Straits Settlements.—SINGAPORE.—April 4th. Municipal Water Department. Three generating sets. (T.Y. 18864/38.)*

Swindon.—March 31st. Great Western Railway. Insulated v.i.r. cables, telegraph ironwork and lamps. (March 11th.)

Uruguay.—MONTEVIDEO.—April 8th. Electricity Supply and Telephones Administration. Single, double and triple pole, and rotary switches. (T.Y. 18880/38.)*

April 7th. Two electric lifts. (T.Y. 18879/38.)*

April 26th. 20,000 insulator bolts or pins. (T.Y. 19287/38.)*

April 20th. Insulators, sockets, lampholders, fuse plugs. transformers for bell installations, &c. (T.Y. 19284/38.)*

Wakefield.—March 21st. R.D.C. Electric wiring, &c., for forty-eight houses. Clerk of the Council, Council Offices, 18, St. John's North.

April 4th. West Riding Public Health and Housing Committee. Electrical work at the proposed child welfare clinic at Church Road, Denaby Main, near Conisborough. Clerk of the County Council, County Hall.

Weymouth.—April 5th. Electricity Department. E.h.v., l.v., p.i. l.c., and s.t.a. cable for one year. (See this issue.)

Whitby.—March 22nd. Electricity Department. 5,000 yd. of 6,600-V, p.i. lead-covered, wire armoured cables. (March 4th.)

Workington.—March 21st. Electricity Supply Department. Stores and materials for one year. (March 4th.)

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*Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Alnwick.—U.D.C. Accepted. Electrical work in forty houses at Felton and thirty at Lesbury.—A. E. Green.

Barrow-in-Furness.—Electricity Committee. Accepted. Voltage regulator (£119).—Ferranti. Feeder switch (£899).—Met.-Vick. Electrical Co.

Buckhaven and Methil (FIFE).—Town Council. Accepted. Electrical work for housing estates: Forty-six houses (£399).—A. Neilson. 106 houses (£913).—Moncrieff Bros. 110 houses (£712).—C. Edelman.

Burton-on-Trent.—Electricity Committee. Recommended. Cable extensions to Tutbury and Anslow rural area (£2,288).—Johnson & Phillips.

Hastings.—Electricity Committee. Recommended for twelve months. House service meters (approx. £6,500).—Met.-Vick. Electl. Co. Cables (approx. £17,000).—W. T. Glover & Co. Cookers.—Jackson Electric Stove Co.; Revo Electric Co. Wash boilers.—Burco. Water heaters.—Heatrae; Santon; Johnson & Phillips.

Hove.—Electricity Committee. Recommended for twelve months. P.i. cables.—Callender's. Fuse-boxes, sealing chambers and connector boxes.—B.I. Cables; W. Lucy & Co. Service boxes.—Callender's; Henley's. Compound.—Callender's. Insulating tape.—Henley's. Switchpillars.—Callender's; Henley's. Meters.—Measurement; Met.-Vick. Electl. Co.; Ferranti. Time switches.—Reason Manufacturing Co. Electric cookers.—G.E.C.; English Electric Co. Cooker control units.—M.K. Electric. Electric water heaters.—Ferranti. Electric kettles.—Bulpitt & Sons. Electric irons.—D. G. E. Barrie. Electric wash boilers.—Revo Electric Co.

London.—DEPTFORD.—General Purposes Committee. Recommended for twelve months. Electric lamps.—G.E.C.

ST. MARYLEBONE.—Electricity Committee. Recommended. Switchgear (£1,769).—Ferguson, Pailin.

Manchester.—Electricity Committee. Accepted. Batteries for electric tower wagons.—Young Accumulator Co. (1929).

Plymouth.—Electricity Committee. Accepted. Cable, joint and service boxes.—W. Lucy & Co.; Callender's. Time switches.—G.E.C.; Horstmann Gear Co. Meters.—Aron Electricity Meter; Ferranti; Electrical Apparatus Co.; Switchgear and Meters. E.h.v., l.v. and pilot cables.—B.I. Cables.

South Shields.—Housing Committee. Accepted in lieu of withdrawn tender. Electrical installations at 652 houses on the Horsley estate (£3,966).—C. Ramsay & Son.

Transport Committee. Accepted. Cable (£450).—B.I. Cables.

Sunderland.—Town Council. Accepted. Electrical installation at the Sir John Priestman Library (£1,282).—Law & Burns.

Swansea.—Electricity Committee. Accepted. Switchgear for supply to Imperial Chemical Industries.—New Switchgear Construction Co.

Swinton and Pendlebury.—Education Committee. Accepted. Electrical installation at the new Swinton Open-air School (£170).—R. W. Christie.

Torquay.—Electricity Committee. Accepted. Cable for twelve months.—Union Cable Co.; Mersey Cable Works.

Wallasey.—Electricity Committee. Accepted. Cable laying (£5,628).—Crompton Parkinson. Feeder panel (£300).—A. Reyrolle & Co. One 250-kVA transformer (£171).—Yorkshire Electric Transformer Co. Switchboard (£83).—New Switchgear Construction Co. Tee-off unit (£169).—Switchgear & Equipment.

Whitby.—U.D.C. Accepted. Electrical rewiring at Whitby Bridge (£199).—Warren Bros.

Wolverhampton.—Electricity Committee. Accepted for twelve months. Transformers.—Electric Construction Co. Wires, cables, compound, &c.—Callender's. House service cut-outs.—Revo Electric Co. Switchgear.—Reyrolle & Co.; Ferguson, Pailin.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March 24th. Institution, London, W.C.2. 6 p.m. Joint meeting with the Plastics Group of the Society of Chemical Industry. "Plastics and Electrical Insulation." Messrs. L. Hartshorn, N. J. L. Megson and E. Rushton.

Meter and Instrument Section.—Friday, March 18th. Institution, London, W.C.2. 7 p.m. Informal discussion on "Meter Practice in Paris" (to be opened by Mr. A. M. Strickland) and "The Future of Meter Testing."

Scottish Centre.—Tuesday, March 22nd. Freemasons' Hall, George Street, Edinburgh. 7.30 p.m. Faraday Lecture on "The Evolution of Electrical Power." Dr. A. P. M. Fleming.

East Midland Sub-Centre.—Tuesday, March 22nd. The College, Loughborough. 6.45 p.m. "Layout and Rupturing Capacity of Protective Devices in Motor Circuits." Mr. J. O. Knowles.

Irish Centre.—Thursday, March 24th. Trinity College, Dublin. 6 p.m. "Evolution of the Solar System." Lt.-Col. K. E. Edgeworth.

North Midland Centre.—Thursday, March 24th. Albert Hall, Leeds. 7.30 p.m. Faraday Lecture.

Tees-side Sub-Centre.—Friday, March 25th. Grand Hotel, Middlesbrough. Annual dinner.

Institute of Marine Engineers.—Friday, March 18th. 85, The Minories, London, E.C.3. Annual meeting.

British Electrical Development Association.—Friday, March 18th. Savoy Hotel, London, W.C.2. 12.45 for 1 p.m. Annual luncheon.

Batti-Wallahs' Society.—Friday, March 18th. Grosvenor House, Park Lane, London. Annual dinner and dance.

Tuesday, March 22nd. Hotel Victoria, London, W.C.2. 12.30 for 12.55 p.m. Luncheon. "Personalities at Westminster." Mr. A. Beverley Baxter, M.P.

Junior Institution of Engineers.—Tuesday, March 22nd. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. 6.45 for 7.30 p.m. Lecture-demonstration on the latest lamps and lighting practice.

Institution of Civil Engineers.—Tuesday, March 22nd. Great George Street, London, S.W.1. 6 p.m. Joint meeting with the Institution of Electrical Engineers. Papers on the Fulham Power Station. Messrs. J. F. Hay, W. E. Parker and H. Clark.

Institution of Electronics.—Wednesday, March 23rd. 64, Great Cumberland Place, London, W.1. 7.30 p.m. "Electrolytic Condensers." Mr. M. V. Pirie.

Association of Supervising Electrical Engineers.—Thursday, March 24th. Aldwych House, London, W.C.2. 6.45 for 7 p.m. Informal meeting. "Foremen in the Electrical Industry." Mr. C. F. Fawdry.

Electrical Power Engineers' Association (*London Local Group*).—Saturday, March 26th. Café Royal, Regent Street, London, W.1. 6.30 p.m. Annual dinner and dance.

Northern Division.—Thursday, March 24th. Engineers' Club, Manchester. 7.15 p.m. "Load Sharing and Frequency Control." Mr. T. B. Somerville.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

COLVIN commutator dressing.
PILCO fires.
MARVELITE or MARBELITE shades.

Readers should enclose stamped addressed envelopes when making their inquiries.

Notes

The International Engineering Congress

The Institution of Electrical Engineers is one of ten associations which are co-operating in the organisation of an International Engineering Congress to be held at Glasgow from Tuesday to Friday, June 21st to 24th (concurrently with the Empire Exhibition, Scotland). Following an opening address by the president, Lord Weir, a series of fifteen addresses, delivered by British and foreign engineers, on various branches of engineering will occupy the first and second mornings, leaving the rest of the time free for visiting the exhibition or some of the many electrical and other factories in the neighbourhood. Four alternative all-day excursions to various beauty-spots have been arranged for the Thursday. The president's dinner to official delegates is being held on the Tuesday evening, followed by a civic reception in the city chambers. On the Friday evening there will be a reception and conversazione at the exhibition. The hon. general secretary of the Congress is Mr. P. W. Thomas, 39, Elmbank Crescent, Glasgow.

The Illuminating Engineering Society

A tribute to the valuable services rendered by the Illuminating Engineering Society was paid by Sir Alexander Maxwell, Permanent Under Secretary of State, Home Office, when proposing the toast of "The Society" at its annual dinner held last Tuesday at the Trocadero Restaurant, London. It was of enormous importance, he said, that a society such as theirs should encourage the attitude that good work rather than profit must be the primary consideration of industry and that the placing of technical knowledge at the disposal of mankind must be its co-operative effort. From the point of view of factory and workshop lighting a great debt of gratitude was owed to the Society, several of whose members had sat on Home Office committees connected therewith. Not only did good lighting increase the output of a factory but it improved the spirits of the workers. The Society's work in street lighting matters had also been of great value. Replying to the toast, Dr. S. English, president of the Society, referred to the excellent work done recently by the local sections of the I.E.S. Mr. Percy Good, senior vice-president, and Sir David Munro, Secretary of Industrial Health Board, also spoke.

E.A.W. Activities

So great has become the demand for lecturing services, both from its own branches and from other associations, that the Electrical Association for Women has compiled a 42-page booklet giving particulars of organisations and firms who are willing to give lectures, possible lecture titles, slides and films which may be borrowed, and other useful information.

Electric Signs

The enterprise of manufacturers of luminous-discharge-tube and other electric signs has necessitated the revision of the British Standard Specification of 1934. The 1938 edition deals intimately with the construction, electrical apparatus, and wiring in a comprehensive manner. While it visualises further developments, standardisation of component parts is both economic to the electric-sign-contractor and the user, by greatly reducing the danger to life and risk of fire. Copies of this specification (No. 559-1938) may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. each (2s. 2d. post free).

I.E.E. Scholarships

Four whole-time scholarships, two for day courses and two for research or post-graduate work, in electrical engineering are offered by the Institution of Electrical Engineers, Savoy Place, London, W.C.2, from which nomination forms are obtainable. Applications must be made before April 15th.

Fatality

An inquest was held on Monday at Southwark into the death of Patrick O'Shea, who was killed at Battersea Power Station on March 9th. It was stated in evidence that O'Shea and six other men were moving a heavy concrete mixer when it came into contact with a cable passing down the outside of a temporary wooden office. It cut through the cable and all the men received severe shock which proved fatal in O'Shea's case. The jury returned a verdict of "Accidental death" and expressed the opinion that the cable should have been adequately protected.

A Lubrication Compendium

A record of the general discussion which took place in October, 1937, on lubrication and lubricants will shortly be obtainable from the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, in two bound volumes of 1,200 pages at 25s. per set, post free. This valuable compendium of current information resulted from the collaboration of twenty-nine British and twenty-two foreign societies, the 136 papers received correlating the major theoretical and practical aspects of the subject.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. K. D. Bullpitt, B.Sc., A.M.I.E.E., M.C., deputy borough electrical engineer of Barnes, has been appointed to succeed Mr. C. S. Davidson, borough electrical engineer, who retires on July 31st. Mr. Bullpitt has been in the service of the Barnes Corporation Electricity Department since 1911, and has been deputy since 1929. He was released to join H.M. Forces in 1914 and served throughout the period of the war, retiring with the rank of captain in the Tank Corps. Prior to taking service at Barnes Mr. Bullpitt was at Chesterfield. His training was received at the Charlton works of Johnson & Phillips, Ltd., and he was educated at Tonbridge.

[*Wykeham Studios.*
Mr. K. D. Bullpitt

Mr. C. Anderson, assistant engineer, Manchester Corporation Electricity Department, has been recommended by the Douglas (I. of M.) Corporation Electricity Committee for the appointment of chief assistant engineer at a salary of £486 a year.

Mr. W. H. Clift, who for a number of years has been manager of the Manchester office of British Insulated Cables, Ltd., has retired after forty-two years' service with the company. He has been succeeded by **Mr. F. W. Leake,** who until recently was in charge of the company's Calcutta office.

Mr. W. H. Clift

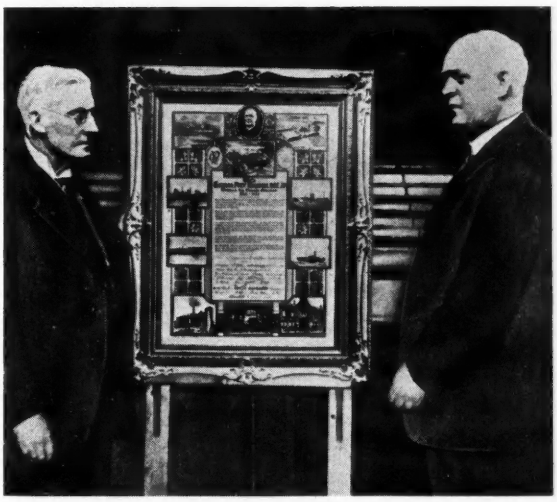
Dr. Willis Jackson, of Burnley, has been appointed Professor of Electrotechnics at Manchester University, in succession to **Prof. R. Beattie.** Dr. Jackson was educated at Burnley Grammar School and for a time was lecturer in electrical engineering at the Manchester College of Technology. He was appointed to his present position of research engineer to the Metropolitan-Vickers Electrical Co., Ltd., in 1936.

On May 7th, at Henley's head office, a presentation of an inscribed silver tea set was made to the company's chief cashier, **Mr. A. H. Foster,** by the members of the cashier's staff, to mark the completion of his forty years' service with the company. The presentation was made by Miss Baker, the oldest member of his staff.

Mr. A. H. Foster, chief cashier of W. T. Henley's Telegraph Works Co., Ltd., receiving a silver tea set to mark the completion of forty years' service with the company

Mr. F. R. Stagg, M.I.Struct.E., a director of Thos. W. Ward, Ltd., Sheffield, since 1927, has been appointed an assistant managing director of the company.

Mr. G. Pate, manager of Carron Company at Falkirk, has recently completed twenty-five years' service in that position, and to mark the occasion he has been presented by the directors and managerial staff of the company with an illuminated address. Our picture shows the presentation being made by Mr. F. L. Burder, chairman of the company.



Mr. F. L. Burder (left) presenting to Mr. G. Pate an illuminated address on the completion of twenty-five years as manager of Carron Company, at Falkirk

Mr. C. W. C. Turner, assistant electrical engineer, H.M. Dockyard, Sheerness, Kent, has been appointed to the torpedo and mining department at the Admiralty. **Mr. A. C. Fitzer,** assistant electrical engineer at the Admiralty, has been appointed to Sheerness Dockyard.

Mr. J. F. Pym, A.I.E.E., has been appointed publicity manager to the Hotpoint Electric Appliance Co., Ltd., in succession to **Mr. J. O. Hinds,** B.Sc., A.M.I.C.E., who has been appointed to a position with the L.M.S. Railway Co. Mr. Pym has been connected with the promotion of sales of B.T.H. products for the last ten years, both in Shanghai and Hong Kong.

Mr. G. F. Gillingham, who was until recently on the staff of the *Broadcaster*, and has had twelve years' continuous publicity work, has joined the executive staff of the Scott Insulated Wire Co., Ltd.

Mr. J. F. Pym

Taunton Town Council has increased the salary of **Mr. L. V. Turner,** the borough electrical engineer, from £800 to £850 per annum as from January 1st, 1938.

Mr. W. J. John, Reader in Electrical Engineering at Queen Mary College, has been appointed by the College Senate to the Chair of Electrical Engineering, which will become vacant on the retirement of **Prof. J. T. MacGregor-Morris** at the end of the session. Mr. John entered Pembroke Dockyard in 1906 as electrical engineering apprentice, and in 1911 went to the Imperial College of Science and Technology, where he obtained the degrees of A.R.C.Sc. and D.I.C., the latter being for post-graduate work in electrical machine design. On leaving the College he joined J. H. Holmes & Co., Newcastle-on-Tyne, as designer of electrical machinery. Subsequently he was at H.M. Signal School, Portsmouth, and with Allen West & Co., Brighton, as chief of the research department, dealing with starting and control apparatus. He became

lecturer in electrical engineering at Queen Mary College (then East London College) and specialised in h.v. engineering. In 1934 he spent a year in Germany studying methods of teaching h.v. technology. He has been associated with the building of the h.v. laboratory at Queen Mary College, which was opened in 1936, and is the author of several papers dealing with h.v. insulators. Prof. MacGregor-Morris has specialised in subjects connected with illumination. In 1915 he carried out extensive experiments with Mr. A. F. Sykes in submarine

Prof. J. T. MacGregor-Morris

Mr. W. J. John

detection, which resulted in the production of a directional hydrophone. He is also the inventor of a portable direct-reading anemometer. During 1925-28 he was director of the electrical engineering section of the summer school for engineering teachers, and in 1928 he was the I.E.E. delegate to the International Commission on Illumination in America. He is the author of many papers on electric incandescent lamps, arc lamps, and illumination generally, and his literary contributions also cover domestic electric cooking and heating, accurate method of magnetic testing, and other subjects.

Mr. E. B. Baxter, for three years traffic superintendent to the Bradford Corporation Transport Department, has been recommended for the position of general manager of the Stockport Corporation transport undertaking at a salary of £700. Mr. Baxter has previously held positions with the Blackpool and South Shields Corporations, Maidstone and District Motor Services, Ltd., and at Bournemouth. He takes up his new position in May.

Mr. R. H. Pilcher, A.M.I.E.E., has been appointed manager of the Ipswich branch of Johnson & Phillips, Ltd. Mr. Pilcher was educated at Rugby, and received his technical training at Faraday House and in the cable, switchgear and transformer departments at the J. & P. works. Subsequently he was appointed outside contract engineer for cable-laying and overhead line contracts. Since 1935 Mr. Pilcher has been a member of the J. & P. sales organisation at the company's Portsmouth branch.

Mr. G. H. Bucher, executive vice-president of the Westinghouse Electric & Manufacturing Co., has been elected president of the company, succeeding Mr. F. A. Merrick, who becomes vice-chairman.

Mr. H. Faulkner, B.Sc., has been nominated for the chairmanship of the South Midland Centre of the Institution of Electrical Engineers for the session 1938-39.

Obituary

Mr. C. W. Mallins.—The funeral took place on Monday last at Rake Lane Cemetery, Wallasey, of Mr. Charles William Mallins, former general manager of the Liverpool Corporation Tramways. Mr. Mallins, who died on March 11th, was seventy-seven years of age, and he leaves a widow. He was born at Liverpool eleven years before tramway traction was adopted in that city. Following a private education, he commenced an apprenticeship to marine engineering, but after some years at sea he entered the service of the Liverpool United Tramways & Omnibus Co., first occupying himself with the construction and maintenance of the permanent way and rolling stock, and later on the commercial side in an administrative capacity. In 1897, when the City Corporation took over the old company, Mr. Mallins was appointed traffic superintendent of the new electric tramway service. In 1905 he succeeded the late Mr. C. R. Bellamy, the then general manager of the undertaking, first with the title of traffic manager and three years later as general manager of the system.

Mr. H. A. Bailey.—We regret to record the death on March 7th of Mr. H. A. Bailey, of the Newcastle branch of the General Electric Co., Ltd., in his fifty-second year, after nearly two years' illness. He received his early training at Rutherford College, Newcastle, and as an apprentice in the British Westinghouse Co., Ltd., with whom he subsequently served for some years. He joined the General Electric Co., Ltd., in 1923 as sales engineer at the company's Sheffield branch, later being transferred in a similar capacity to Newcastle.

Mr. T. H. Parrott.—The death is announced at the age of seventy-one of Mr. Thomas Henry Parrott, chairman and managing director of Belliss & Morcom, Ltd.

Wills.—Mr. C. R. Allensby, director of Benham & Sons, and president of the Institution of Heating and Ventilating Engineers, who was fatally injured in a railway accident in January, left £17,441 (net personalty £13,974).

Mr. R. W. Edwards, chairman and managing director of the Mid-Southern Utility Co. and other utility companies, left £57,133, with net personalty £51,286.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Anderson & Geary, Ltd.—Private company. Registered March 9th. Capital, £1,000. Objects: To carry on the business of manufacturers of, agents for and dealers in television, radio and other energy wave reception and transmission instruments and apparatus, musical instruments and appliances, &c. The permanent managing directors are L. J. Anderson (chairman), 16, High Road, Willesden Green, N.W.10; and A. C. Geary, 37, The Green, Edminton, N.9. Secretary: Mrs. H. A. Anderson.

Radiometrics (Nottingham), Ltd.—Private company. Registered March 9th. Capital, £200. Objects: To carry on the business of radio, electrical and television engineers and dealers in electrical apparatus, television apparatus, &c. The permanent directors are: Mrs. S. E. Gration, 42, Lyncroft Avenue, Ripley, Derby; and Mrs. M. E. Shaw, Woodlinkin, Langley Mill, Derbyshire. Solicitors: A. J. Cash & Sons, Ripley.

Sparkbrook Radio, Ltd.—Private company. Registered March 3rd. Capital, £100. Objects: To acquire the business of a radio dealer now carried on by R. D. Chisholm at 139, Stratford Road, Sparkbrook, Birmingham, as The Sparkbrook Radio Depot. The subscribers are: R. D. Chisholm and R. Chisholm, both of 19, Beoley Road, Redditch, Worcs. R. D. Chisholm is first and permanent governing director. Secretary: R. D. Chisholm. Registered office: 138, Stratford Road, Sparkbrook, Bimingham, 11.

Air Conditioning (G. W. Cross & Co.), Ltd.—Private company.—Registered March 12th. Capital, £2,000. Objects: To carry on the business of air conditioners, electricians, engineers, founders, &c. The directors are: A. D. E. Davenish, 155, Gloucester Terrace, W.2; J. D. Butcher, 65, Chiltern Road, Sutton, Surrey; F. H. W. Hope, 7, Downshire Close, W.1; and G. W. Cavell, 104, Streatham Road, Mitcham. Registered office: 95, Petty France, S.W.1.

Jays Radio, Ltd.—Private company. Registered March 11th. Capital, £200. Objects: To carry on the business of manufacturers of and dealers in radio and television sets, radio and electrical goods, &c. The directors are: J. Whitehead, 43, Effingham Road, Lee, S.E.12; and J. Rosen, 10, Beresford Road, Highbury, N.5. Registered office: 27, Walbrook, E.C.4.

J. W. Gladwin & Sons, Ltd.—Private company. Registered March 12th. Capital, £600. Objects: To carry on the business of electricians, electrical and mechanical engineers, &c. The directors are: E. W. and H. G. Gladwin, 41, Hainton Avenue, Grimsby; and H. Foulgar, 9, Recto Avenue, Grimsby. Secretary: E. W. Gladwin. Solicitor: James Young, 9, West St. Mary's Gate, Grimsby.

W. H. Hall (Waterloo), Ltd.—Private company. Registered March 10th. Capital, £250. Objects: To acquire the business of an electrical engineer and contractor carried on by W. H. Hall at Waterloo. The permanent directors are: W. H. Hall, 46, Ilford Avenue, Crosby, Liverpool, 23, and Mrs. R. M. Hall, 52, De Villiers Avenue, Crosby, Liverpool, 23. Registered office: 63, Crosby Road North, Waterloo, Lancs.

J. Norton & Co., Ltd.—Private company. Registered March 10th. Capital, £5,000. Objects: To acquire the business of a manufacturer of bakelite mouldings, engineers, aluminium die casters and general engineers now carried on by L. J. Norton as J. Norton & Co., at Hylton Works, Heath Mill Lane, Birmingham. The directors are: L. J. Norton, 23, Oaklands Road, Four Oaks, Warwickshire, and M. Norton, 23, Oaklands Road, Four Oaks. Registered office: Hylton Works, Heath Mill Lane, Birmingham.

A. Mills & Son (Edinburgh), Ltd.—Private company. Registered in Edinburgh, March 4th. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in radio, electrical and television apparatus, gramophones, &c. The directors are: A. Mills and A. D. Mills, both of 254, Dalry Road, Edinburgh. Registered office: 258, Dalry Road, Edinburgh.

A. Hudspeth, Ltd.—Private company. Registered March 4th. Capital, £500. Objects: To carry on the business of dealers in electric washing machines, wireless sets and acces-

sories, electric and other refrigerators, cycles and spare parts, &c. The directors are: A. Hudspeth and Mrs. H. M. Hudspeth, both of 17, Lichfield Road, Linthorpe, Middlesbrough. Registered office: 31, The Longslands, Middlesbrough.

Field's Radio, Ltd.—Private company. Registered March 5th. Capital, £1,000. Objects: To acquire the business of a radio and cycle dealer now carried on by C. Lister at 41, Hall Gate, Doncaster, as "Field's Radio." The directors are: C. Lister, 5, Priory Place, Doncaster; and Mrs. J. Lister, 11, Thornhill Avenue, Doncaster. Registered office: 41, Hall Gate, Doncaster.

Returns of Electrical Companies

Ismay Industries, Ltd.—The nominal capital has been increased by the addition of £950,000 beyond the registered and reduced capital of £1,050,000. The additional capital is divided into 300,000 1st preference shares of £1 and 800,000 2nd preference and 1,800,000 ordinary shares of 5s.

Cape Electric Tramways, Ltd.—Particulars have been filed of £75,000 debentures (second series) authorised by resolution of December 1st, 1937, and covered by trust deed dated February 11th, 1938 (created abroad and comprising solely property outside the United Kingdom), charged on shares in various tramway and transport companies. The whole amount is now issued. Syfrets Trust Co., Ltd., are the trustees. These debentures are to rank *pari passu* with £200,000 debentures (first series) secured by trust deed dated April 3rd, 1935.

Johnson Electricals, Ltd.—Capital, £100 in £1 shares. Return dated October 13th, 1937. Four shares taken up. £4 paid. Mortgages and charges, nil.

Century Power & Light, Ltd.—Capital, £100 in 200 shares of 10s. Return dated December 10th, 1937. Seven shares taken up. £3 10s. paid. Mortgages and charges, nil.

G. K. Jensen & Co., Ltd.—Capital, £5,000 in 1,000 ordinary and 4,000 preference shares of £1. Return dated January 12th, 1938. 1,000 ordinary and 3,000 preference shares taken up. £4,000 paid. Mortgages and charges, nil.

Watamps, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 2nd, 1938, to secure £1,250. Holedr: M. Weinbren, 2, Hyde Park Square, W.1.

Ship Carbon Company of Great Britain, Ltd.—Satisfaction in full on December 29th, 1937, of charge dated December 1st, 1932, and registered August 12th, 1935. (Notice filed March 1st, 1938.) (According to the register of mortgages the amount owing on the charge registered August 12th, 1935, was £7,000.)

Radio & Electrical Equipment Renters, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 22nd, 1938, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Hydrelex Electrical Utilities, Ltd.—Capital, £3,000 in 2,000 preference and 1,000 ordinary shares of £1. Return dated December 31st, 1937. 1,000 preference and 1,000 ordinary shares taken up. £2,000 paid. Mortgages and charges, £1,000.

Cables Investment Trust, Ltd.—Capital, £4,000,000 in £2,000,000 preference and £2,000,000 ordinary stock. Return dated August 24th (filed September 7th), 1937. All stock taken up. £4,220,000 paid (including £220,000 premium). Mortgages and charges, £2,870,000.

Cable Covers, Ltd.—Capital, £10,000 in £1 shares. Return dated October 25th, 1937. 1,002 shares taken up. £1,002 paid. Mortgages and charges, nil.

Cathodeon, Ltd.—Capital, £100 in £1 shares. Return dated November 19th, 1937. All shares taken up. £100 paid. Mortgages and charges, nil.

London Rentals, Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares beyond the registered capital of £10,000.

Ignition and Electrical Services, Ltd.—Capital, £100 in £1 shares. Return dated September 9th, 1937. All shares taken up. £100 paid. Mortgages and charges, nil.

Vale-Royal Electric Lamp Manufacturing Co., Ltd.—Particulars filed of £16,000 debentures authorised February 17th, 1938, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Electrical Equipment Company (Leicester), Ltd.—Capital, £4,000 in 3,500 ordinary and 500 employés' preference shares of £1. Return dated November 18th, 1937. 3,150 ordinary shares taken up. £3,150 paid. Mortgages and charges, nil.

Wm. F. Brown Radio, Ltd.—Capital, £1,500 in £1 shares. Return dated October 12th, 1937. All shares taken up. £1,000 paid. £500 considered as paid. Mortgages and charges, nil.

Bustler Electric Co. (London), Ltd.—Capital, £2,000 in £1 shares. Return dated August 21st (filed October 19th), 1937. 1,250 shares taken up. £1,200 paid. £50 considered as paid. Mortgages and charges, £800.

Andrew, Son & Ballard, Ltd.—Capital, £200 in £1 shares. Return dated September 15th (filed December 22nd), 1937. 142 shares taken up. £1 paid. £141 considered as paid. Mortgages and charges, nil.

Cymric Relay Service, Ltd.—Capital, £1,000 in £1 shares. Return dated December 9th, 1937. 650 shares taken up. £650 paid. Mortgages and charges nil.

Baxter and Caunter, Ltd.—Capital, £10,000 in 6,000 5 per cent. cumulative preference and 4,000 ordinary shares of £1. Return dated January 4th, 1938. 4,000 preference and 3,002 ordinary shares taken up. £7,002 paid. Mortgages and charges, nil.

Carliol House, Ltd.—The nominal capital has been increased by the addition of £12.000, in £1 shares, beyond the registered capital of £193,400. The North-Eastern Electric Supply Co., Ltd., holds nearly all the issued shares.

Dudley Radio Relay Service, Ltd.—Capital, £4,500 in 3,000 shares of £1 and 6,000 shares of 5s. Return dated October 6th, 1937. 98 £1 and 6,000 5s. shares taken up. £98 paid. £1,500 considered as paid. Mortgages and charges, £4,436 5s. 4d.

Brown & Co. (Electrical Engineers), Ltd.—Capital, £5,000 in £1 shares. Return dated November 30th, 1937. 4,529 shares taken up. £12 paid. £4,517 considered as paid. Mortgages and charges, nil.

Pollard & Smith, Ltd.—Capital, £2,000 in £1 shares. Return dated December 15th, 1937. All shares taken up. £2,000 paid. Mortgages and charges, nil.

McGreevy Brothers (Fleetwood), Ltd.—Capital, £2,000 in £1 shares. Return dated December 14th, 1937. 1,450 shares taken up. £1,450 paid. Mortgages and charges, nil.

City Notes

North Metropolitan Electric Power Supply Co.—The annual meeting was held on March 15th when Sir James Devonshire (deputy chairman), who presided in the absence of Lord Ashfield, read the chairman's speech, in the course of which he said that the number of kWh supplied in 1937 was 690,800,000, and this total represented an increase of 93,200,000 kWh as compared with 1936. Of the sales through their distribution undertakings, 80 per cent. was for lighting, cooking and domestic purposes, 15 per cent. for power purposes, 3 per cent. for street lighting and the balance in their showrooms and offices. The lighting and domestic consumption increased in 1937 by one-third. The maximum demand on their system was 235,980 kW, as compared with 199,220 kW in 1936. In order to afford a bulk supply to a number of authorities they had over a period of years laid down an extensive transmission system comprising at December 31st 920 miles of underground mains and overhead lines and 438 sub-stations. They now operated directly twenty-seven distribution undertakings, whose systems comprised 2,562 miles of underground mains and overhead lines and 492 sub-stations. Thirty-six showrooms and local offices had been established at a total capital cost of £375,000. The number of consumers supplied both directly and indirectly was 375,067, an increase of 38,345, or 11.4 per cent. The number supplied directly by the company was 253,400, an increase of 40,802. The average consumption by domestic consumers last year was 709 kWh, which represented an increase of 102 kWh per consumer, or nearly 17 per cent. as compared with the previous year. With regard to electricity for street lighting, 1,723 additional street lamps had been installed during the year, bringing the total to 13,501. Of their total requirements of 755,200,000 kWh during 1937, 448,200,000 kWh was produced at their generating stations, the balance being imported from the Central Electricity Board. The reconstruction of the Brimsdown "A" station was now nearing completion and when it was finished it would have a capacity of 52,500 kW. Their three generating stations would then have a combined capacity of nearly 200,000 kW. Refering to the financial results for the year, Lord Ashfield said that the operating expenses showed an increase due to larger purchases from the Board and the higher cost of coal. The average price of coal used at the generating stations during 1937 was 14½ per cent. higher than during the preceding year, and part of the coal used was purchased under contracts entered into before the commencement of the year. Under the contracts entered into during 1937 the prices showed an average increase of about 20 per cent., as compared with 1936 prices, and it was probable that further increases would occur. The rise in the last year or so in the level of their operating expenses was serious when considered in relation to their charges, and a continued increase in the costs of operation might render it necessary to reconsider the present rates of charges for electricity supplied.

The Scottish Power Co., Ltd.—Presiding at the annual meeting on March 11th Mr. G. Balfour (chairman) said that the maximum demand as at December 31st amounted to 98,520 kW, as compared with 89,024 kW in the previous year, and the total sales amounted to 285,600,000 kWh, an increase of 31,850,000 kWh, of which 121,000,000 kWh was sold to the Central Electricity Board, and about 164,000,000 kWh for general power, domestic and business purposes. The resultant "unit" rate over the whole of their scattered areas was 0.869d. per kWh, and excluding the Central Board contract, 1.309d. per kWh. They added 287 miles to their main transmission system and 142 miles to the l.v. mains, making a total of 3,330 miles of main cables and distributors in service at December 31st. During the year they connected an additional 9,216 consumers, an increase of 15 per cent., bringing the total up to 70,006. Supplies were afforded to six additional small burghs and thirty villages, and in addition they inaugurated public lighting supplies in five additional burghs and twenty-one country districts. The street lamps connected to their mains totalled 10,619, scattered over sixty-five burghs and 125 county districts. Their demonstration vans covered a mileage of 110,679 and van and canvass calls totalled 28,037. They now had 5,350 hired cookers and other appliances in use, of which over 1,600 were added during the year, in addition to cookers and appliances purchased. They had continued their policy of absorbing small isolated undertakings into their larger companies. The Orders of the undertakings at Grantown-on-Spey and Strichen and of the Tain municipal undertaking were merged during 1937 into the Scottish Highlands Special Order, and the two small subsidiary companies had been voluntarily liquidated. During the year an application was made by the Grampian Company for a Special Order covering an area of approximately 200 sq. miles in the counties of Ross and Cromarty and Sutherland, extending northwards from Tain to Helmsdale along the coast and including Dornoch, Golspie, and Brora. This Order had been made by the Minister of Transport, and should be finally sanctioned at an early date. The whole of the hydro-electric plants at Rannoch and Tummel had given every satisfaction during the year. The Garry-Ericht development had been completed, the five-mile tunnel connecting Loch Garry and Loch Ericht having been finished last October. The Cuaich-Seilich development was proceeding and the water of the Cuaich would be available in the autumn of this year. The Seilich development, which necessitated four or five miles

of tunnel, would be available in about two years' time. The load in their areas was developing rapidly, and by the time the Seilich development had been completed it was clear that they would have connected load to absorb the whole of the output. It was therefore necessary to make plans for future years, and the directors had made preliminary arrangements for the provision of additional power as soon as they had absorbed the resources available from all the developments in hand.

The Metropolitan Electric Supply Co., Ltd.—An attack on the London and Home Counties Joint Electricity Authority was made by Mr. George Balfour, M.P., chairman of the company, when presenting his annual report last Tuesday. He reminded those present that six years ago he had declared that the Authority, after nearly seven years of existence, had reached the stage when it could submit proposals for the organisation of electricity distribution in its area. Up to date no such proposals had materialised, but the Authority had entered into the competitive field of electricity supply which, in his opinion, was quite an irregular proceeding for a body of its kind. Probably the public had now material upon which to judge the trading activities and efficiency of the Authority, and as to whether it had made any contribution to the great and rapid advances in consolidating and improving the supply in its area. It seemed impossible to escape from authorities, boards and Bills, all supposed to help the supply undertakings and the consumers. Surely they had had enough experience now to guide them and teach them how little could be done by such means? Referring to the effect of the regulations and restrictions of the London Electricity Supply (No. 2) Act, 1925, the chairman said that in the London area in 1927 the company sold 34,000,000 kWh, the revenue was £476,460 at an average price of 3.36d. per kWh. In 1937 it sold 75,320,000 kWh for a revenue of £561,671 at an average price of 1.79d. per kWh. In the Western area, which is outside the operation of the London Act, in 1927, 20,150,000 kWh was sold for a revenue of £183,200 at an average price of 2.18d. per kWh, as compared with 75,612,100 kWh sold for £393,616 at an average price of 1.25d. in 1937. During the past seven years reductions in charges to consumers were equivalent in the London area to £389,830, in the Western area to £455,635 and to subsidiary companies to £1,164,690. Further reductions for the second half of this year would amount to over £65,000. These reductions had been effected in spite of rising costs. Last year 19,177 new consumers were connected, making a total of 186,865, and the total kilowatt demand required was 140,825 kW, of which 34,640 kW was for the London area (2,190 kW increase) and 106,185 kW in the Western area and subsidiary companies (14,494 kW increase). Total sales of electricity amounted to 443 million kWh. Excluding bulk supplies (119 million kWh) nearly one-third of the energy sold was for industrial purposes at an average of 0.98d. per kWh. Eighty per cent. of domestic supplies were given under the all-in tariff at an average of 1.48d. A thousand additional consumers had taken advantage of the assisted wiring scheme, bringing the total so served to 3,000. Last year 10,240 cookers, heaters, wash boilers, water heaters, &c., were put out on hire, bringing the total to 37,000.

Telegraph Construction & Maintenance Co., Ltd.—Presiding at the annual meeting on March 15th Mr. C. F. Campbell (chairman) said that the year 1937 had been a satisfactory one. The works had been fully occupied in every branch and they were deriving great benefit from the extension to the power cable shop which was completed during the year. The output of power cable during the year had increased by 18 per cent. over 1936, but owing to a considerable reduction in prices, and the necessity for a great deal of overtime during the early part of the year, the profits were not in proportion to those of the previous years. The sales of their metal branch had risen by over 30 per cent. and those of the gutta-percha sundries branch had almost doubled. The sales of their radio relay cables and aerial wires had not expanded to the extent they anticipated owing to the uncertainty of the future of this industry. A new development was their air-spaced cable capable of dealing with very high frequencies. It had already been used in several important connections and especially for television. In their submarine branch, which they owned jointly with Siemen Bros., the amount of cable manufactured during 1937 was 70 per cent. more than in the previous year, and the works was still fully occupied. During the year seven paragutta telephone cables were manufactured and laid, of which five were for the Post Office; two of them between England and Holland, two between Scotland and Ireland, and one between England and Ireland. Owing to the renewed demand for submarine cables and the necessity to replenish their stocks of gutta-percha they had restarted the manufacture of gutta-percha on the Selborne Estate in Malaya. In connection with the treatment of gutta-percha as dielectric and the general improvement of submarine cable for transmission purposes they had now established a special research branch which was making an intensive study of manufacturing processes and transmission problems.

The County of London Electric Supply Co., Ltd., reports a net revenue for 1937 of £2,378,110, as compared with £2,162,340 in the preceding year. To this is added £425,289 brought in, making £2,803,398. From this the following charges are met: Debenture and loan interest, £365,082; provision for difference between issue and redemption price of debenture stock, £6,759; reserve for depreciation and contributions to sinking funds, £791,796; taxation reserve, £100,000; general reserve, £150,000. The balance available is £1,389,762. The ordinary dividend for the year is maintained at 10½ per cent. by the final distribution of 7½ per cent., and £483,397 is carried forward. The sales to the company's consumers amounted to 1,199.5 million kWh, as against 1,034.6 million kWh for the previous year. In addition, 715,453,000 kWh was exported to the Central Electricity Board. The consent of the Electricity Commissioners has been received to the installation of another 75,000-kW set together with two boiler units at the Barking power station. During the year the transmission and distribution network was increased by 601 miles of underground mains and overhead lines; 170 transformer stations were also added to the system, including the Valley Road capital sub-station, the largest distributing sub-station in the country. Two new showrooms have been established and others reconstructed and enlarged. Additional contracts for public street lighting have been obtained from the Borough of Romford and the Hornchurch, Dagenham and Merton and Morden Urban District Councils. New contracts have been obtained from the Chigwell U.D.C. and from four other local authorities in the rural districts of Essex. Meeting: March 22nd.

The North-Eastern Electric Supply Co., Ltd., reports a profit for the year ended December 31st of £1,410,801, as compared with £1,244,590 in the preceding year. From this is deducted the following:—Loan and debenture interest, &c., £247,818; sinking fund for redemption of debenture stock, £92,959; reserve for special depreciation and contingencies, other than equalisation of dividends, £400,000; and reserve for plant renewals and improvements, £100,000. The balance is £570,024, which with £166,373 brought in makes £736,397 available. The final ordinary dividend is 4½ per cent., making 7 per cent. for the year (same), and £217,720 is carried forward. The report states that the work in connection with the frequency standardisation has made satisfactory progress and will be practically completed during the current year. All 40-cycle generation by the company's plant ceased last August. The connections to the system at the end of the year amounted to 1,228,542 h.p., an increase during the year of 116,379 h.p. The directors propose to make a contribution of £5,000 to King's College, Newcastle-on-Tyne.

The Hendon Electric Supply Co., Ltd.—Presiding at the annual meeting held on March 14th Mr. C. F. Tufnell (chairman) said that despite the rising cost of coal they had, up to the present, refrained from raising their charges to the general public. How long they could follow that policy he was unable to say, but they would make every endeavour to avoid having to make an increase. Mr. K. A. Scott-Moncrieff (managing director) said that they viewed with some apprehension the progress of the Hire Purchase Bill now going through the House of Commons and could only hope that the Electricity Commissioners would safeguard the interests of public utility undertakings, as they feared, particularly in connection with assisted wiring schemes, that the effect of the Bill would be to damp down activities.

London Associated Electricity Undertakings, Ltd., reports that the dividends received in 1937 from its constituent companies (now merged in Central London Electricity Ltd.) totalled £459,700. These payments were made after Central London Electricity had placed £75,000 to reserves. For 1936 the dividends received were £518,329, but the holding company made its own appropriation of £55,000 to reserve. The sales of the group amounted to 419 million kWh, an increase of 8.55 per cent. The final dividend on the ordinary stock is 4 per cent., making 7 per cent. for the year (same), and £294 is carried forward (against £818 brought in).

The Electrical Distribution of Yorkshire, Ltd.—Presiding at the annual meeting on Monday last Mr. R. W. Wickham (chairman) said that the addition to the number of their customers during the year was greater than ever before, and brought the total to over 105,000. They had doubled the number of their customers in the last five years, while steadily reducing their average selling price. Electricity House, Ltd., set up jointly with the Yorkshire Electric Power Co., had established shops in a number of towns where the user could test, by experience, the advantages of each piece of apparatus. They felt that Electricity House would materially assist in increasing their sales of electricity.

The Llanelly and District Electric Supply Co., Ltd., held its annual meeting on March 14th when Mr. M. A. Edwards (chairman), who presided, said that the sales, including those of their subsidiary, the Gorseinon Electric Light Co., amounted to 44,228,259 kWh, an increase of 6,635,899 kWh. During the current year they proposed to reduce the running charge of the two-part tariff from 1d. to ¾d. per kWh. Certain other adjustments had been made in their tariffs. The number of passengers carried by the trolley vehicles and omnibuses totalled 6,345,315, an increase of 22½ per cent.

Pinchin Johnson & Co., Ltd., report a net profit for 1937 of £385,594, as against £379,363 for 1936. Taxation, including N.D.C., absorbs £92,000 and it is proposed to pay a final ordinary dividend of 10 per cent., making 17½ per cent., for the year, less tax. This is payable on the capital as increased by the 10 per cent. free share distribution in the previous year, and compares with a total dividend of 20 per cent., on the smaller capital in respect of 1936.

The Newcastle & District Electric Lighting Co., Ltd., reports a gross profit for 1937 of £73,619, as compared with £73,461 for 1936, to which is added £16,464 brought in. After providing £7,652 for debenture interest, &c., £150 for leasehold redemption fund, £31,001 for depreciation and £3,000 for general reserve, it is proposed to pay a dividend of 7 per cent. (same) and to carry forward £16,781.

British Insulated Cables, Ltd., reports a profit for 1937 of £821,358, as compared with £765,695 for 1936. The final ordinary dividend is 10 per cent., plus a cash bonus of 5 per cent., making 20 per cent. This distribution is the same as for 1936, but is on capital as increased by the 20 per cent. scrip bonus approved in April last year. Reserve receives £100,000 and depreciation £143,091. The balance carried forward is £446,992 (against £380,879 brought in).

The British Thomson-Houston Co., Ltd., in its report for the past year shows a profit of £651,673, after providing for tax and N.D.C., as compared with £553,714 in the previous year. Depreciation receives £271,861, and general reserve £100,000. The ordinary dividend for the year is maintained at 7 per cent., and the balance carried forward is increased by £17,827 to £206,408. The report states that both orders received and output from the works were greater than for the previous year, and the orders on hand show a substantial increase over those for 1936.

The Clyde Valley Electrical Power Co. reports a balance of profit, including amount transferred to contingency fund, of £518,468, which with £97,800 brought in, makes £616,268. The final ordinary dividend is 5 per cent., again making 8 per cent. for the year, and £140,268 is carried forward. The report states

that the 30,000-kW turbo-alternator with boiler plant, &c., in course of construction last year at Yoker power station is now in commission. Work is proceeding in connection with a further unit of similar capacity with boiler plant, &c., at this station. Meeting: Glasgow, March 29th.

The City of London Electric Lighting Co., Ltd.—Another year of steady progress was reported by Mr. P. D. Tuckett, chairman, at the annual general meeting of the company on Wednesday. Output, he said, had increased by over 6,000,000 kWh, gross revenue by some £33,000, and a further 3,814 kW had been added to the mains, bringing the total connections to 147,860 kW. In spite of increasing costs the financial results had enabled a further substantial reduction in charges to be made. The company's load was a peculiar one and he believed that no other undertaking in the country had so small a proportion of domestic consumers (10 per cent.) or so large a proportion of business consumers (60 per cent.). Furthermore, the average annual account of each consumer (£45) was larger than that of any other undertaking. Regarding the distribution question, the chairman hoped that Parliament, having made what had proved to be the initial mistake of insisting on too many undertakings, would not now go to the other extreme and insist on too few. The company was fully alive to the value of co-operation and the agreement entered into last September with the County of London Electric Supply Co., Ltd., had already resulted in four pieces of co-operative effort, while the formation of a single managerial area embracing, with its own distribution area, the Holborn and Finsbury areas of the County Company, was under consideration. During the year a contributory pension scheme for employés was introduced.

The South London Electric Supply Corporation, Ltd., reports a revenue for 1937 of £138,260, as compared with £121,205 in the preceding year, from which the following allocations have been made:—Loan and debenture interest, £14,295; difference between issue and redemption price of debentures, £685; sinking funds, £53,141; taxation, £2,500; and reserve, £19,386. The final ordinary dividend is 4 per cent., making 7 per cent. for the year (same), and £27,039 is carried forward (against £17,932 brought in). Meeting: March 23rd.

The American General Electric Co.—A *Reuter* message states that for 1937 the net profit of the American General Electric Co. was $63,547,000 (equal to $2.21 per share), as compared with $43,947,000 ($1.52) for 1936. Sales were $349,740.000 (against $268,545,000), and inventories at the end of 1937 totalled $93,768,000 ($60,049,000). Bookings during January and February were $41,348,000, as compared with $64,229,000 for the corresponding period of 1937. The company has declared a dividend of 30 cents on the common stock.

The Oxford Electric Co., Ltd.—Edmundsons Electricity Corporation has sent letters to the public holders of the Oxford Company's 6 per cent. cumulative preference shares offering to acquire all or any of these shares on a share exchange basis. The *Financial Times* reports that Edmundsons are prepared to issue five 6 per cent. cumulative preference shares of £1 each, fully paid, in Edmundsons for every six preference shares in the Oxford Company. The letter points out that the Corporation already owns 82 per cent. of the ordinary and nearly 41 per cent. of the cumulative preference shares in the Oxford Co. Shareholders are given up to March 21st to accept the terms.

Switchgear & Cowans, Ltd., report a profit for 1937 of £57,618, as compared with £37,483 in the previous year. From this is deducted depreciation £4,000 and income-tax and N.D.C. £18,141, leaving a net profit of £35,477, to which is added £5,057 brought in. The dividend on the ordinary shares for the year is maintained at 20 per cent., less tax, but is paid on increased capital. Reserve receives £15,000 and £7,534 is carried forward. Meeting: March 22nd.

The East Anglian Electric Supply Co., Ltd., reports a net revenue for 1937 of £57,193, as compared with £54,299 in 1936. The available balance is £19,454 (against £27,554). The ordinary dividend for the year is 4 per cent. (same), and £6,873 is carried forward. During the year 290,000 £1 ordinary shares were issued at par with rights as regards dividends as from

Ericsson Telephones, Ltd., reports a trading profit for 1937 of £230,707, as compared with £185,003 for 1936, and a net profit of £148,704 (against £140,602), to which is added £35,761 brought in. The final ordinary dividend is 12 per cent., tax free, making 18 per cent. for the year (same), plus a bonus of 7 per cent., tax free (same). General reserve receives £40,000 and £36,708 is carried forward. The report states that a record volume of orders was received during the year and the enlarged works were employed to capacity throughout the year. Orders in hand are in excess of those held at this period of last year. Meeting: March 30th.

The South Wales Electric Power Co. reports a revenue for 1937 of £303,741, as compared with £252,672 in the preceding year, and a net revenue of £70,042 (against £61,124), plus £5,298 brought in. The dividend for the year is 5 per cent. (against 4½ per cent.) on ordinary stock of £1,100,000 and on £200,000 for the period May 27th to December 31st. The balance carried forward is £6,275. Meeting: March 22nd.

The British Aluminium Co., Ltd., in a preliminary statement, reports a profit for 1937 of £459,341, as compared with £361,158 in the preceding year. This is arrived at after providing for taxation and debenture interest, depreciation reserve (£50,000), and placing £100,000 to reserve. The final ordinary dividend is 8½ per cent., making 12½ per cent. for the year, and is paid on capital which is larger by 50 per cent. than a year ago. For 1936 10 per cent. was paid. The balance carried forward is £101,423, as against £71,158 brought in.

The Greengate and Irwell Rubber Co., Ltd., reports a net trading profit for 1937 of £62,395, as compared with £69,851 in the previous year. The final dividend is 6¼ per cent., making 10⅜ per cent. for the year (against 12½ per cent.), and £27,210 is carried forward.

The West Gloucestershire Power Co., Ltd., reports a net balance for 1937 of £85,594, as compared with £76,245 in the previous year. Reserve receives £41,871, and depreciation of vehicles, &c., £3,774. The ordinary dividend is maintained at 2 per cent. and £623 is carried forward (against £446 brought in).

Waste Heat & Gas Electrical Generating Stations, Ltd., reports a net profit for the year to January 31st of £12,756, as compared with £22,332 for the preceding year, to which is added £17,289 brought in. The ordinary dividend for the year is maintained at 8 per cent., and £18,046 is carried forward.

The National Gas & Oil Engine Co., Ltd., reports a net profit for 1937 of £70,100, as compared with £34,641 in 1936. The ordinary dividend for the year is 4 per cent. (against 2 per cent.), £31,500 is placed to general reserve, and £16,200 is carried forward (against £14,200 brought in).

The Rangoon Electric Tramway & Supply Co., Ltd., has declared a final dividend on the ordinary shares of Rs.1 2a per share, free of Burma tax (against R.1). An interim dividend of 6a. was paid in October last (same).

The Isle of Thanet Electric Supply Co., Ltd., has recommended a dividend of 4 per cent., less tax at 5s. in the £, on the ordinary shares for 1937 (unchanged).

The Cornwall Electric Power Co. reports a profit of £21,802 for 1937, to which is added £6,508 brought in. The ordinary dividend is maintained at 5 per cent. and £5,310 is carried forward.

The Tyneside Tramways and Tramroads Co. reports a profit of £14,801 for 1937, plus £3,126 brought in. Reserve receives £5,000 and an ordinary dividend of 5 per cent. is paid, leaving £5,031 to be carried forward.

The Dublin United Tramways Co. (1896), Ltd., reports a net revenue for 1937 of £78,468. The final ordinary dividend is at the rate of 4 per cent. per annum, making 3 per cent. for the year (same), Mortgage and debenture redemption receive £20,000 and £13,094 is carried forward (against £17,872 brought in).

Brown Bros., Ltd., report a net profit for the year to January 16th of £101,631, as against £92,645 in the preceding year, plus £80,369 brought in. The final ordinary dividend is 10 per cent., making 12½ per cent., less tax, and £84,269 is carried forward.

The Telephone & General Trust, Ltd., is paying a final dividend of 5 per cent., less tax, making 8 per cent., less tax (same), and a dividend of 8 per cent., less tax, on the "A" ordinary shares (same).

Crabtree Electrical Industries, Ltd., has declared an interim dividend of 5 per cent., less tax.

The Jarrow and District Electric Traction Co. reports a profit of £34, for 1937 which, with £49 brought in, is carried forward.

Stocks and Shares

TUESDAY EVENING.

THE grave political developments of the past few days have left a very unpleasant mark upon Stock Exchange quotations and upon the course of business. Prices gave way on the assumption that increase in income tax and other sources of taxation will be inevitable. The gilt-edged stocks in the British Government list fell back considerably. Whatever the newspapers may say to the contrary, the fact remains that there has been a good deal of selling, not in small amounts only, nor for account of the Continent alone. Stock Exchange jobbers in the Consol market admit quietly that they have been taking substantial lines of stock from holders from all over this country.

The fall in gilt-edged stocks had an immediate effect upon prices in other parts of the House. Many of the front-rank Industrials gave way sharply on the expectation that the Budget next month will impose further taxation upon a variety of commodities. It is true that American shares—utility and railroad—have presented a fairly robust front to the general tendency, though this firmness had to meet realisations from people who sold American stocks and shares in order, no doubt, to provide cash against possible emergencies which might arise from other directions.

There has been a fair amount of business doing in a number of Stock Exchange markets. In spite of the general disposition being nervous and apprehensive, a lurking idea was present that something might unexpectedly happen to change the course of the present pessimism and provide a rope with which to hang the numerous bears.

Electricity Supply Shares

The market in electricity supply shares was shaken out of its equanimity by the set-back in gilt-edged prices, or by the developments which gave rise to that disturbance. As a result, prices have been marked down by about 1s. all along the line. County of London Electric has announced the seventh successive annual dividend of 10½ per cent. This rate has been maintained during a period when the capital has been progressively expanded by issues of shares and debentures. Present capital is larger than last year's by the issue, last June, of a million 4 per cent. preference shares at 21s. 6d. and half a million pounds of 3¼ per cent. preference stock at 94½. These are quoted now at 21s. 6d. and 95¾ respectively. The ordinary, which are 1s. lower at 48s., give a return of 4⅜ per cent. On London Associated Electricity, which company has just issued its report, the return is £4 13s. 4d. per cent. on the basis of the 7 per cent. dividend and a price of 30s. for the shares. Metropolitans, at 46s., and North Metropolitans, at 47s. 6d., have lost part of the rises in price which followed publication of the respective results. Holders of preference shares as a class follow with more than academic interest the negotiations for the control of the Oxford Electric undertaking. From the latest move by Edmundsons Corporation, in offering five of its 6 per cent. preference shares, now quoted at 28s., in exchange for six Oxford Electric preference shares, standing at a nominal 22s. 6d., it is calculated that the offer is worth about 23s. 4d. per Oxford share.

Cable Manufacturing Shares

Despite a satisfactory dividend and report by British Insulated Cables, prices of the leading cable shares have failed to recover from the set-back which began a fortnight ago with the publication of the Enfield Company's figores. These, it will be remembered, came as a disappointment after the optimistic interpretation which had been placed on the previous announcement of a 60 per cent. free scrip bonus. The fall in Enfield Cable shares from 5½ to 4⅝ (still cum-bonus) reflects the adjustment of expectations to a reduced scale of future dividends on the newly increased capital. British Insulated Cables announce record profits, and the dividend payments total 20 per cent. for the year. The dividend is thus maintained at last year's rate on capital enlarged by the 20 per cent. scrip bonus which accompanied the 1936 distribution. Despite satisfaction with this agreeable sequel to an issue of new capital, the price of British Insulated shares, at 4½, is $\frac{3}{16}$ lower on the week. Callender's have fallen to the same figure; Henley's at 16s. 3d., Telegraph Constructions at 38s. 9d., and Siemens at 27s. 6d. have shed $\frac{1}{16}$ apiece. There is a good deal of interested speculation over a report that the manufacture of cables is due to start in a few weeks' time at the Aberdare Cables factory.

American Affairs

With President Roosevelt continuing to blow hot and cold—with the balance on the chilly side—in his attitude towards the American business community, there is still little encouragement for those who look to the United States to revive the pace of world trade and, incidentally, of Stock Exchange markets. The President's latest pronouncement showed anything but an intention to compromise on his favourite New Deal reforms. Meanwhile, the business news suggests that the headlong decline in activity has been partially checked. Many prices on Wall Street are still, however, by general consent, higher than is warranted by American industry in its present state. This implies an expectation of eventual recovery. According to the latest weekly figures output of electricity in the United States is 7½ per cent. lower than a year ago. This contrasts with a 10 per cent. rise in our own figures for February. Prices of base metals are responding to the likelihood of armament demands having a strengthening effect upon metals and commodities alike.

Lancashire Dynamo and Crypto

After 2½ per cent. was paid on Lancashire Dynamo ordinary shares in 1933, the dividend was doubled in each of the following three years, bringing the distribution up to 20 per cent. for 1936. A year ago, the ordinary capital was increased by an offer to shareholders, on bonus terms, of one new share for three old. On the capital thus increased, the company now carries on the good work with the declaration of a final dividend making 25 per cent. for the year, earnings being equal to about 38 per cent. on the ordinary shares. From the preliminary profits statement, it is clear that events have well borne out the confident forecast made at last year's meeting. Notwithstanding this satisfactory state of affairs, the price of the shares has sagged from 3¼ to 3⅛, at which the yield is practically 8 per cent. on the money.

Miscellaneous Matters

Tillings ordinary have had a steep fall to 40s., ex- the 25 per cent. capital bonus. The latter was paid out of reserves, which, despite this depletion, still amount to a round million pounds. On the generally accepted view that the 10 per cent. dividend will be maintained on the larger capital, the yield on Tillings is 5 per cent. London Transport "C" stock is 1½ points down, at 82. British Electric Traction deferred, at 800, shows the spectacular loss of 162 points. Sir Josiah Stamp's view, given at the L.M.S. meeting, of the outlook for the coming year, served only for a short time to put some stiffening into the list of home railway stock prices, which subsequently weakened. In the absence of support in the shape of news regarding the hoped for developments, Cable and Wireless ordinary fell away from 65 to 60½, and the preference shed a point to 100. Globe Telegraph ordinary fell in sympathy from 14⅛ to 14. Electrical equipment shares turned dull along with many other industrial issues. Of the market leaders, General Electrics at 70s., and Associated Electricals at 39s. 6d., are each 1s. down; it is a long time since these could be bought to yield 5 per cent. on the money. Walsall Conduits shares have fallen to 22s. 6d., the excellent dividend, making 55 per cent. for the year, having no effect.

Calcutta Electric

The relatively high yield obtainable from Calcutta Electric ordinary shares has lately attracted some attention, and a little business has been passing in the shares at around 41s. Serving a population of a million and a half in and around Calcutta, the company's output has been multiplied about two-and-a-half times in the past ten years. For the last three years ordinary dividends have been paid at the rate of 12 per cent., free of income tax. The company has lately intimated that the standard rate should be regarded, in future, as 10 per cent. At this, the yield on the shares at 41s. works out at £4 17s. 6d. per cent., tax free, equivalent to a return of 6½ gross, taking income tax—perhaps optimistically—at 5s. in the £.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price Mar. 15.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	65/-	−¼	4 12 4
City of London	1	7½	7½	34/-	—	4 8 3
Clyde Valley	1	7	8	38/6	−1/-	4 3 0
County of London	1	10½	10½	48/-	−1/-	4 7 6
Edmundson's 7% Pref.	1	7	7	32/6	—	4 6 2
Do. Ord.	1	8	9	37/-	−1/-	4 17 3
Elec. Dis. Yorkshire	1	9	9	41/-	−1/-	4 7 10
Elec. Fin. and Securities	1	12½	12½	50/-	−¼	5 0 0
Elec. Supply Corporation	1	11	12	52/6	—	4 11 5
Lancs Light and Power	1	7½	7½	33/-	−6d.	4 11 7
Lond. Assot. Electric	1	—	7	30/-	−¼	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	105	−1	4 15 4
Metropolitan	1	10	12	46/-	−6d.	5 4 3
Midland Counties	1	7½	8	36/-	−1/-	4 9 0
Mid. Elec. Power	1	8	9	2	−¼	4 10 0
North Eastern Electric Ordinary	1	6	7	30/-	−1/-	4 13 4
Do. 7% Pref.	1	7	7	32/6	—	4 6 2
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	47/6	−¼	4 4 2
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	36/-	−1/-	4 9 0
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/-	−1/6	8 6 8
Yorkshire Elec.	1	8	8	39/-	−1/-	4 2 1
PUBLIC BOARDS						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	116	—	4 6 2
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–93	„	—	3½	100	—	3 10 0
London Elec. Trans. Gtd.	„	—	2½	92½	—	2 14 2
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A	„	—	4½	118½	—	3 16 3
Do. do. B	„	—	5	121½	—	4 2 4
Do. do. C	„	4	4½	82	−1½	5 3 8
West Midlands Joint Elec. 1948–68	„	—	5	113	—	4 8 6
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	130½xd.	−3½	6 18 0
Anglo-Am. Tel. Pref.	Stock	6	6	110½	−1	5 8 7
Do. Def.	„	1½	1½	27	—	5 11 3
Cable & Wireless 5½% Pref.	„	4½	5½	100	−1	5 10 0
Do. Ord.	„	—	—	60½	−4½	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	14	−⅛	3 18 7
Do. do. Pref.	10	6	6	13⅛	—	4 8 1
Great Northern Tel.	10	20	20	39½	—	5 1 3
Marconi-Marine	1	10	7½	27/6	−¼	5 9 1
Oriental Telephone Ord.	1	12*	12*	2⅜	—	4 9 3
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	6/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	13½	−2	—
British Electric Traction Def. Ord.	„	5	5	800	−162	—
Do. do. Pref. Ord.	„	8	8	160	—	4 17 0
Brazil Traction	$100	70 cts.	$1	10	−½	—
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	102½	—	4 17 9
Mexican Light Common	$100	Nil	Nil	1½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	12	58/9	−¼	4 1 8
West Riding	1	6½	10	38/9	—	5 3 3
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1⅞	—	8 0 0
Assoc. Elec. Ord.	1	8	10	39/6	−1/-	5 1 3
Do Pref.	1	8	8	38/-	—	4 4 6
Babcock & Wilcox	1	8	10	40/-	−2/-	5 0 0
British Aluminium Ord.	1	7½	10	43/3	−¼	4 12 10
British Insulated Ord.	Stock	20	20	4½	−¼	4 17 1
Brush Ord.	Stock	Nil	Nil	19½	—	—
Callender's	1	15	15	4½	−¼	3 12 9
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	23/9	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	36/3	—	5 10 6
Enfield Cable Ord.	1	25	25	4½	−¼	5 14 2
English Electric	1	Nil	10	28/6	−1/6	7 0 4
Do. do. Pref.	1	6½	6½	25/-	—	5 4 0
Ericsson Tel.	5/-	25	25*	1⅞	—	3 6 7
Ever Ready	5/-	35	45	25/6	—	8 16 6
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	70/-	−1/-	5 0 0
Henley's	5/-	30	15	16/3	−¼	4 12 4
Do. 4½% Pref.	1	4½	4½	1½	+⅛	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	−9d.	5 3 6
Johnson & Phillips	1	½	10	38/3	−6d.	5 4 7
Lancashire Dynamo	1	20	25	3½	−½	7 19 9
Siemens Ord.	1	6	7½	27/6	−¼	5 9 1
Telegraph Construction	£1	7½	10	38/9	−¼	5 3 1

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

745. "Electric domestic ovens or cookers." W. A. Strickley and Ionite, Ltd. December 8th, 1936. (480012.)

9155. "Electric alarm systems." S. M. Hayes and R. M. Baker. August 19th, 1936. (479928.)

13843. "Dynamo machines with core armature and commutation system." G. La Rovere. May 15th, 1936. (480245.)

17085. "Magneto generators." Bendix Aviation Corporation. June 20th, 1935. (480100.)

19355. "Methods of producing electrical oscillations." Baird Television, Ltd., D. M. Johnstone and V. Jones. July 13th, 1936. (Cognate application 27286/36.) (479935.)

19477. "Device for use with the dialling plates of automatic telephone instruments." B. Segeal. July 13th, 1936. (480248.)

21894. "Thermionic valve amplifiers." Plessey Co., Ltd., and C. E. G. Bailey. August 8th, 1936. (Addition to 21893/36.) (479936.)

22499. "Negative electrode for alkaline accumulators." Accumulatoren-Fabrik Akt.-Ges. and E. Langguth. August 15th, 1936. (480109.)

22524. "Automatic frequency control circuits for carrier-wave receivers." R. I. Kinross. August 15th, 1936. (480017.)

22580. "Means for improving the sound emitted by loud-speakers and the like." G. Lakhovsky. July 11th, 1936. (480313.)

22593. "Tubing for use in electric lamps, more particularly gaseous electric-discharge lamps." G. H. Hutaff, jun., and H. B. Norris. August 17th, 1936. (480315.)

22615. "Electric transformers." R. C. K. Young. August 17th, 1936. (480318.)

22690. "Electric relays and amplifiers." L. B. Turner. August 18th, 1936. (480253.)

22737. "Adjusting devices for wireless apparatus." E. Czobor and M. Czobor. August 22nd, 1935. (479938.)

22795. "Electron multipliers." Baird Television, Ltd., V. Jones and T. M. C. Lance. August 19th, 1936. (480263.)

22845. "Thermally actuated spinners, motors, and the like for imitation fires and other purposes." Premier Electric Heaters, Ltd., G. H. Collins and A. E. Newton. August 19th, 1936. (480332.)

22852. "Regenerative detector circuits." G. W. Johnson (Philco Radio & Television Corporation). August 19th, 1936. (480019.)

22952. "Electrolytic manufacture of hyposulphite." A. Carpmael (I. G. Farbenindustrie Akt.-Ges.). August 20th, 1936. (480334.)

22972. "Alkaline accumulators." Soc. des Accumulateurs Fixes et de Traction. August 21st, 1935. (480274.)

22981. "Cathode-ray tubes." Baird Television, Ltd., D. M. Johnstone and C. Szegho. August 20th, 1936. (480275.)

23020. "High vapour pressure electric-discharge lamps." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. August 21st, 1936. (480020.)

23060. "Television transmission method." Radioakt.-Ges. D. S. Loewe. August 22nd, 1935. (480279.)

23069. "Electro-magnetically operated step-by-step single-motion switches." Standard Telephones & Cables, Ltd. E. P. G. Wright and E. A. H. Bowsher. August 2nd, 1936. (480281).

23071. "Device for lowering the no-load voltage of a transformer more particularly intended for feeding an electric arc." L. Mellersh-Jackson. (Soc. l'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude.) August 21st, 1936. (480282.)

23095. "Electric transformers." A. L. De M. Coutinho. August 21st, 1935. (Cognate application 23096/36.) (479942.)

23227. "Electric immersion heaters." General Electric Co., Ltd., and O. W. Humphreys. August 24th, 1936. (479944.)

23552. "Differential piston circuit-breakers." Allmänna Svenska Elektriska Aktiebolaget. August 28th, 1935. (479947.)

23642. "Photo-electric exposure meters." Metrawatt Akt.-Ges. Fabrik Elektrischer Messgeraete. August 31st, 1935. (Addition to 453913.) (480286.)

24326. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. September 6th, 1935. (480118.)

24461. "Excess-demand warning and/or controlling devices for use in electricity supply systems." Chamberlain & Hookham, Ltd., and S. James. September 8th, 1936. (480119.)

24662. "Protective discharge tubes." Westinghouse Electric & Manufacturing Co. November 21st, 1935. (479952.)

25164. "Electric circuit-breakers." G. Dewar, and Metropolitan Vickers Electrical Co., Ltd. September 15th, 1936. (479953.)

25964. "Manufacture of moulded articles containing metallic inserts." General Electric Co., Ltd., and W. Harrison. September 24th, 1936. (480184.)

26164. "Electro-magnetic devices." British Thomson-Houston Co., Ltd. September 26th, 1935. (480026.)

26445. "Thermostatic switches." Trico Products Corporation. April 24th, 1936. (480027.)

27103. "Cathode-ray tubes." Vereinigte Glühlampen und Electricitäts Akt.-Ges. October 14th, 1935. (479961.)

27778. "Electric incandescent lamps for projection and like purposes." General Electric Co., Ltd. (Patent-Treuhand für Electrische Glühlampen). October 13th, 1936. (479964.)

29027. "Device for use with electric torches and the like for gaining attention of attendants in theatres and for like purposes." E. T. March. October 26th, 1936. (480193.)

29470. "Pocket electric lamps." E. T. March. October 29th, 1936. (480194.)

29569. "Electric busbars." General Electric Co., Ltd., A. F. Searle and F. Evans. October 30th, 1936. (480195.)

29789. "Apparatus for carrying out electrometrical tests or measurements." Siemens & Halske Akt.-Ges. November 1st, 1935. (Cognate applications, 29790/36, 29791/36 and 29792/36.) (480125.)

29905. "Colour-lighting equipment." Holophane, Ltd., and R. G. Williams. November 3rd, 1936. (480126.)

30898. "Electrically heated irons." General Electrical Co., Ltd., and F. D. Davidson. November 12th, 1936. (480199.)

30996. "Variable electric condensers." W. Rogers and Wingrove and Rogers, Ltd. November 13th, 1936. (480200.)

32819. "Conveyor for cylindrical articles and more particularly dollies for electric cells" K. Bud, and Economic Distributors, Ltd. November 30th, 1936. (479972.)

32932. "Electric cable systems." Okonite-Callender Cable Co., Inc. December 7th, 1935. (479973.)

33214. "Multi-core high-frequency electric cables." Felten & Guilleaume Carlswerk Akt.-Ges. December 3rd, 1935. (Addition to 475374.) (480133.)

34695. "Concentric high-frequency cables having air-space insulation." Siemens & Halske Akt.-Ges. December 17th, 1935. (480136.)

35312. "Electric-discharge devices." Westinghouse Electric & Manufacturing Co. January 4th, 1936. (480208.)

35402. "Automatic biasing circuit for thermionic amplifying tubes." Magyar Wolframlampa Gyar Kremenezky Janos Reszvenytarsasag. December 24th, 1935. (480209.)

35638. "Electric fuses of the cartridge type." Callender's Cable & Construction Co., Ltd., and W. F. Slater. December 29th, 1936. (480044.)

1937

521. "Electrothermic apparatus for remote measurement and control." G. Bloch. January 7th, 1937. (Convention date not granted.) (479975.)

1804. "Secondary emission electron multipliers." M-O Valve Co., Ltd., and W. H. Aldous. January 21st, 1937. (479978.)

3704. "Electric rectifier systems." British Thomson-Houston Co., Ltd. February 8th, 1936. (480050.)

4301. "Piezo-electric crystal apparatus." Standard Telephones & Cables, Ltd. February 21st, 1936. (479979.)

5595. "Magnetron electron-discharge device arrangements for use on very short waves." Telefunken Ges für Drahtlose Telegraphie. February 24th, 1936. (480052.)

6980. "Wireless telegraph systems." Cable & Wireless Ltd., A. M. Humby and J. A. Smale and E. G. Copper. March 9th, 1937. (480289.)

7055. "Electric cable systems." Okonite-Callender Cable Co., Inc. December 7th, 1935. (Divided out of 478850.) (480144.)

7214. "Electro-deposition of rhodium." Etablissements Marret, Bonnon, Lebel & Guieu. March 11th, 1936. (480145.)

7591. "Electrical transformers." Siemens-Schuckertwerke Akt.-Ges. March 16th, 1936. (480146.)

7699. "Sealing of conductors into vacuum vessels particularly for electron tubes." C. Lorenz Akt.-Ges. March 16th, 1936. (480057.)

9750. "Electric coupling contacts." E. Challet. April 6th, 1936. (479984.)

10157. "Electric signal transmission systems." Standard Telephones & Cables, Ltd. April 10th, 1936. (480219.)

11570. "Printing-telegraph systems." Marconi's Wireless Telegraph Co., Ltd. May 7th, 1936. (480150.)

11684. "Piezo-electric crystal devices." Standard Telephones & Cables, Ltd. June 12th, 1936. (479987.)

12386. "Excess-current fuse with a heating-coil and a spring-loaded switching member." A. Appel and B. Appel (trading as Leopolder & Sohn). April 30th, 1936. (480151.)

12462. "Luminescent screen for electric-lamp bulbs or tubes filled with rare gases or mercury vapour." H. G. G. Desmarest. May 2nd, 1936. (480225.)

12745. "Circuits for sound reproduction." Zeiss Ikon Akt.-Ges. May 19th, 1936. (480062.)

13105. "Electric-discharge tubes." C. Lorenz Akt.-Ges. May 9th, 1936. (480066.)

13297. "Methods of regulating the characteristic of reactances." British Thomson-Houston Co. May 9th, 1936. (480067.)

13375. "Regulating electric quantities in current convertors." Allmänna Svenska Elektriska Aktiebolaget. May 12th, 1936. (479990.)

13450. "Selectivity control for radio receivers." Hazeltine Corporation. June 12th, 1936. (479991.)

13700. "Velocipede dynamo-lamps." R. Herbst. October 26th, 1936. (480069.)

13872. "Electrical discharge apparatus." Siemens-Schuckertwerke Akt.-Ges. May 16th, 1936. (480071.)

14317. "Portable dynamo-lamps." C. D. Di. Quitengs. May 22nd, 1937. (480072.)

14586. "Cathode-ray tubes." Farnsworth Television, Inc. June 1st, 1936. (480073.)

15220. "Electron-discharge apparatus." Standard Telephones & Cables, Ltd. June 30th, 1936. (480074.)

15875. "Measurement of the modulation of an aerial current." Siemens & Halske Akt.-Ges. July 11th, 1936. (479993.)

175569. "Electro-magnets having pivoted armatures." J. Estoup. June 29th, 1936. (480295.)

18012. "Alternating-current measuring instruments." Siemens & Halske Akt.-Ges. June 26th, 1936. (480080.)

18633. "Evacuating means for electrical discharge vessels." Siemens-Schuckertwerke Akt.-Ges. July 3rd, 1936. (480081.)

19199. "Means for joining the ends of electric cables." H. D. Wight, J. S. Hawthorne and Sunderland Forge & Engineering Co., Ltd. July 10th, 1937. (480083.)

19987. "X-ray devices." Physikalisch Technische Werkstaten Ges. July 18th, 1936. (479998.)

20093. "Electric battery lamps." Elektrotechnische Fabrik Schmidt & Co. Ges. July 21st, 1936. (479999.)

21130. "Method of supplying current to high-pressure metallic vapour arc lamps." Egyesult Izzolampa Es Villa-Mossagi Reszvenytarsasag. July 30th, 1936. (480234.)

21201. "Electric transformer insulation." British Thomson-Houston Co., Ltd. July 30th, 1936. (480087.)

22688. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). August 18th, 1937. (480090.)

23071. "Methods of testing the power of electrical appliances." British Thomson-Houston Co., Ltd. August 21st, 1936. (480306.)

24420. "Alloys for resistance units." S. Conn. September 17th, 1936. (480307.)

(Continued on next page.)

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abingdon.—Houses (89), Drayton Road; borough surveyor.

Baillieston.—Houses (55), Garrowfield estate; Arthur & Son, The Cross, Airdrie.

Baldock.—Houses (71), Norton Road (£26,959); U.D.C. surveyor.

Barrow-in-Furness.—Houses (56), Prospect Road; R. Bant.

Batley.—Houses (20), Mount Pleasant; Abbert, Ltd.

Beckenham.—School, West Wickham, for the E.C.

Birkenhead.—Technical and Commercial College buildings, Borough Road, for the E.C.; Willink and Dod, architects, Cunard Buildings, Liverpool.

Birmingham.—Factory and offices, Thimble Mill Lane; J. H. Parsons & Son, builders, King's Heath.

Blackpool.—Showrooms and offices, Caunce Street and Collingwood Avenue; C. H. MacKeith.

Blaenavon.—Houses (58); U.D.C. surveyor.

Boston.—Houses (36); W. R. Beardall, R.D.C. surveyor.

Bristol.—School, Patchway; county architect, Shire Hall, Gloucester.

Bury.—Cinema, Walmersley Road; J. A. Dargie, architect. Transport House, The Crescent.

Campbeltown.—Cinema and restaurant, &c., for George Green, Ltd., Glasgow; J. Fairweather & Son, 184, Trongate, Glasgow.

Cardiff.—Underground car park, Wood Street (£76,752); city engineer.

Carlisle.—Houses (70), Petterill estate (£24,237); J. Millar & Sons.

Chaddesden.—Cinema, for Eskay, Ltd.; A. J. Thraves, architect, Whitefriars House, Friar Lane, Nottingham.

Chertsey.—Reconstruction of Stepgates school (£14,591); H. H. & F. Roll, Ltd.

Chorley.—Houses (32), Pall Mall and Sylvester Road; W. Hampson, builder, 31, Pall Mall.

Colne.—Market hall (£14,938); borough engineer.

Congleton.—Houses (64), Bromley Farm estate; J. Hood, borough surveyor.

Coventry.—Factory and offices, Tile Hill, for A. C. Wickman, Ltd., Coventry.

Crewe.—Houses (102), near Timbrell Avenue (£37,998); L. Reeves, borough surveyor.

Dagenham.—Concert hall and swimming bath, Old Dagenham Park (£27,000); U.D.C. surveyor.

Devonport.—Cinema, Fore Street; Morgan, Willmott & Partners, architects, 9, Windsor Place, Cardiff.

Dewsbury.—Houses (58), Spen Valley Road, Ravensthorpe; Mitchell Brothers, builders.

Douglas (I.O.M.).—Houses (16), Laureston estate; Corkill & Co.

Dover.—Police station; borough engineer.

Dundee.—Factory, Mairfield Crescent, Fairmuir; H.S.C. Brick Manufacturing Co.

Eastbourne.—School, Eldon Road; borough engineer.

Exeter.—Houses (64), Buddle Lane estate; borough surveyor.

Feltham.—Houses (34), Carlton Avenue; Gordon Carrington Co., Ltd.

Flimby (CUMBERLAND).—Houses (66); P. A. Baines & Son, Ltd., builders, Culgaith, Cumberland.

Gateshead.—Houses, Hill Crest estate; W. Leech, builder, Clayton Street, Newcastle-on-Tyne. Houses (11), Shipcote estate; S. Thompson, builder, 36, Ashtrees Gardens, Gateshead. Cinema, Askew Road West, for J. Scott; R. Burke, architect, Singleton House, Newcastle-on-Tyne. Cinema, Bensham Avenue; Smelts Theatres, Ltd., 125, Westgate Road, Newcastle-on-Tyne. Library, Redheugh; borough engineer.

Glamorganshire.—Hospital, Church Village (£230,000), for the C.C.; E. Taylor & Sons, contractors, Littleborough, Manchester.

Glasgow.—Five-storey building as West of Scotland headquarters of the Scottish Amicable Building Society, Gordon Street and West Nile Street; the manager, Edinburgh.

Harpenden.—Houses (70), Westfield estate; U.D.C. surveyor, Harpenden Hall.

Hexham.—Houses (20), Fourstones; W. Dixon and Son, architects, 1, Collingwood Street, Newcastle-on-Tyne.

Hove.—Development of West Blatchington estate; Braybons, Ltd.

Ipswich.—School, Cliff Lane (£21,650); borough surveyor.

Leadgate (Co. DURHAM).—Cinema for Leadgate Cinemas, Ltd.; R. Gallacher, Ltd., contractors, Cemetery Road, Blackhill, Co. Durham.

Lepton (HUDDERSFIELD).—Houses (36), Highroyd estate; H. Pakes, U.D.C. surveyor, Council Offices.

Lingfield.—Cinema, Godstone Road, for New Era Cinema Co., Ltd.; Seth-Smith, Monro & Matthews, architects, 46, Lincoln's Inn Fields, London, W.C.2.

Liverpool.—Factory, near Speke Hall Road, for Gregory's Photogravure, Ltd.; Ormorod & Banister, architects, 66, Rodney Street.

London.—(BATTERSEA).—Rebuilding Central school (£49,615); Cropley Bros., Ltd., Dog Kennel Hill, S.E.22. (STEPNEY).—Tenements, Padstow Place, £45,451); borough engineer. (FULHAM).—Dwellings, Carnworth Road (£10,400) and Olympia site (£62,800); borough engineer. Tenements, Albert Mews (£51,997); W. J. Simms, Sons & Cooke, Ltd.

Maidenhead.—Cinema, Market Street, for L. Morris; C. E. Wilford, architect, 10-12, Market Street, Leicester.

Manchester.—Houses (30), Boothroyden Road, Blackley; R. W. Murray, 118, Urmston Lane, Stretford. Store (£750,000), Deansgate, for Kendal Milne & Co.

Middlesbrough.—Underground car park, Victoria Square; borough engineer.

Morpeth.—School (£24,774); R. Carse & Son, Ltd.

Newcastle-on-Tyne.—Block of business premises and offices, New Bridge Street, for E. Watson & Son; T. Clements & Sons, contractors, Selborne Gardens. Shops and offices, Elswick Road, for J. H. Grant; White & Pearson, architects, 33, Groat Market.

Newton-in-Makerfield.—Houses (98), Crow Lane estate (£38,924); U.D.C. surveyor.

Northumberland.—School, Belford (£15,551), for the County E.C.; J. G. Green & Son, Ltd. Extensions to school, Cramlington (£16,890), for the County E.C.; Gibson Bros.

Nottingham.—Cinema, Derby Road, Eastwood, for the Rex Cinemas, Ltd.; A. G. Wheeler & Co., architects, Eastwood. Langley Mill, Nottingham.

Ossett.—Houses (28), Swithenbank estate; borough engineer.

Oxford.—Repertory theatre, Beaumont Street; J. C. Leed, architect, 10, Beaumont Street.

Porthcawl.—Cinema; G. Benyon & Sons Cinemas, The Casino.

Queenborough (KENT).—Houses (54), Rushenden; J. W. Smith, borough surveyor.

Ramsgate.—School, Ellington (£16,489), for the E.C.; Rice & Son, Ltd., contractors, Margate, and 15, Stockwell Road, London, S.W.9.

Renfrewshire.—Schools, Bellville Place, Greenock (£29,000), and Port Glasgow (£30,000); architect, County Council, Paisley.

Richmond (SURREY).—Houses (112), Ham estate (£49,550); borough engineer.

Rochdale.—Market with shopping arcade and hotel, Yorkshire Street (£78,000); borough surveyor.

Royston.—Houses (29), Hollycroft (£13,784), for U.D.C.; Glew Bros., builders, Royston.

Rugeley.—Houses (92), Brereton Road site; W. E. Rogers, U.D.C. surveyor.

Rushden.—Factory, near Higham Road; John White, Ltd.

Scarborough.—Amusement hall, shops and flats, Eastborough, for C. Westall; Wilkinson & Smith, architects.

Seaham Harbour.—Houses (204), West Park estate; U.D.C. surveyor.

Sheffield.—Houses (38), Norton Lees Square; F. B. Skinner & Sons, Ltd., builders, Little Norton Lane. Woodseats, 8. Cinema, Barnsley Road; Sandford, Fowler & Potter, architects.

Shropshire.—School, Hodnet, for the County E.C. Shrewsbury.

Southend-on-Sea.—Extension to general hospital (£55,000), for Board of Management; secretary.

Southwick (SUSSEX).—Houses (24), Mile Oak Road site; G. W. Warr, U.D.C. surveyor.

Steyning.—Cinema for Radion Cinema Constructions, Ltd.

Stockton-on-Tees.—Houses (18); W. Marsh, builder, Bishopton Road.

Sunderland.—School, Ford estate; O. H. Mark, architect, Education Offices.

Surrey.—Gymnasium, St. Helier schools, Morden (£20,649); county architect, Kingston-upon-Thames. Reconstruction of County Hospital, Kingston-on-Thames (£608,285), for the County E.C.; Saxon, Snell & Phillips, architects.

Sussex.—Schools, Thakeham (£28,100), Rustington (£15,040), and extension to Worthing Art School (£13,000), for the West Sussex County Council; county architect, Chichester.

Taunton.—Houses (52), near Priorswood Road; Colborne's Estates, Ltd.

Warlingham (SURREY).—Houses (27), Farleigh Road; Sinden, Tompkins & King.

Wednesfield.—Houses (34), Woodend Road and Hickman Street; A. H. Lawrence, surveyor, Council Offices, High Street.

West Hartlepool.—Houses (44), Wensleydale Road, &c., for the S. S. Durham and Northumberland Real Estate Co., Ltd.; Heslop & Johnson, architects, Church Square, West Hartlepool.

Witham.—Houses (50), Church Street, for U.D.C.; Jepp & Sons, builders, Bocking. Houses (32), Church Street, for U.D.C.; T. H. Belchem, builder, Kelvedon.

Wolverhampton.—Houses (32), near Pinfold Lane; W. C. Darby. Houses (92), Pond Lane; borough engineer, Town Hall. Factory, Showell Road; Tinsley Wire Industries, Ltd.

Worthing.—Ten shops and flats, Offington Lane, for Liverpool Gardens, Ltd.; Jordan & Cook, architects.

Published Specifications (*Concluded from preceding page*)

26055. "Electric-discharge lamps." British Thomson-Houston Co., Ltd. September 25th, 1936. (480091.)

30951. "Photo-electric exposure meters." Metrawatt Akt.-Ges. Fabrik Elektrischer Messgeraete. August 28th, 1936. (Divided out of 480286.) (Addition to 453913 and 480286.) (480310.)

31032. "Electric switches having arcing barriers." British Thomson-Houston Co., Ltd. September 26th, 1935. (Divided out of 480026.) (480094.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 9th:—

Philora Discharge Lighting.—Look How You Can See! (lettering and design). No. 583015. Class B. Electric lamps (ordinary) and electric lighting fittings of ordinary metal.—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Hawklight. No. 582752. Class 15. Lighting fittings made wholly or principally of glass.—O. C. Hawkes, Ltd., Globe Works, Bromsgrove Street, Birmingham.